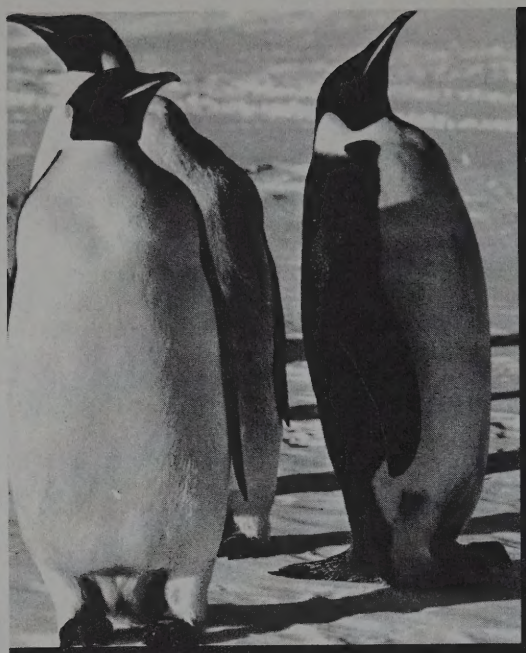
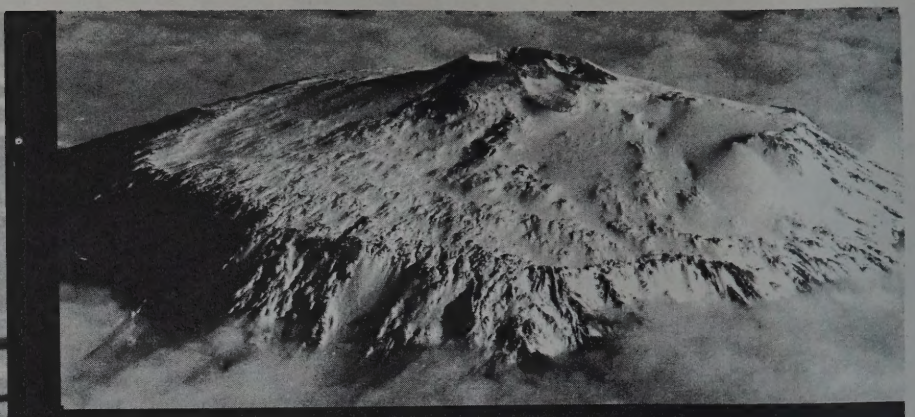
THE POLAR TIMES





Photos by Ralph Payne and Ken Thornsley (U.S. Navy) and by Kendrick Frazier

Clockwise: Emperor penguins

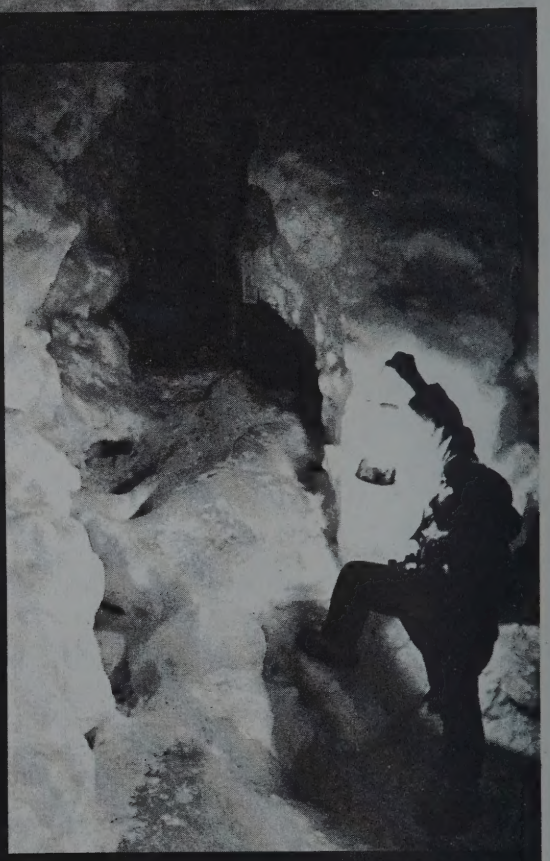
Mt. Erebus, active volcano

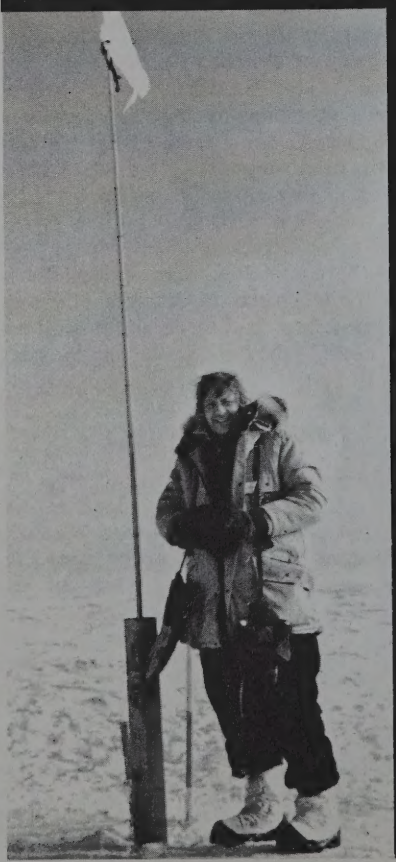
Ice caves near Scott Base

Soviets welcome Americans to Vostok

Frazier at South Pole

Entrance to South Pole station





The Polar Times

No. 78 *JUNE 1974*

SHIPS ARE DOCKING AT GIANT ICE CUBE

U.S. Antactic Bases Getting Supplies at Man-Made Pier

By WALTER SULLIVAN
The New York Times

Feb. 13 —

An ice cube with its top surface as large as a football field has been fabricated in Antarctica and, after a succession of mishaps and crises, has proved a successful ship dock.

About 5 million pounds of cargo have been unloaded onto it and trucked to the American base on McMurdo Sound. Furthermore, no fuel shortage is anticipated at the polar stations since the Navy tanker Maumee managed to penetrate the pack ice that isolates Antarctica and deliver 5.5 million gallons of oil.

After pulling away from the floating, ice-cube pier, however, the tanker drifted backward into a solid wall of ice on Jan. 29 and crushed her steering assembly with the rudder hard left. Despite frigid winds and driving snow, mechanics were able to install an improvised steering gear.

The tanker was escorted out through the ice by the Coast Guard icebreaker Staten Island and steamed toward New Zealand under escort by the icebreaker Glacier. The ship was last reported nearing Wellington for drydock repairs.

The giant ice cube was produced by hosing successive layers of sea water onto an ice platform enclosed in a wall of snow. A thickness of 27 feet was needed to achieve a serviceable dock.

This was done in Winter Quarters Bay, so named because a summer break-up of ice enabled Robert Falcon Scott to berth his ship Discovery there for the winter of 1902. Only occasionally does this inner part of McMurdo Sound become icefree under natural circumstances.

Hence, the Staten Island carved a 17-mile channel to the new dock early in the current Antarctic summer—which coincides with the northern winter.

The cargo was to resupply the various American stations in Antarctica, including the one at the South Pole that is moving into its new, dome-covered "city." A geodesic dome 164 feet wide and 50 feet high has been erected there to shelter three prefabricated buildings from bitter polar winds. The buildings will house laboratories, dining and sleeping facilities and the post office.

It took the 156 men six months to build the new dock and when it was complete, with the bay still frozen over, the men drilled holes two inches wide every 18 inches into the relatively thin bay ice along the seaward face of the dock.

It was hoped that the Staten Island, after cutting her channel up the sound, could shave off the bay ice along this "perforated" line, leaving a smooth face for docking.

"Unfortunately, according to a report from the base, "the ice cube developed cracks running the entire width of the man-made block of ice." Since the dock was afloat, it seemed for a time that it might break up and drift out to sea.

Navy Seabees, or construction specialists, filled the cracks with straw and volcanic cinders erupted from nearby Mount Erebus. With steel cables they attempted to lash the pier against the shoreline. By Jan. 17 the men had covered the entire pier with a foot-deep layer of volcanic material and a bridge had been built to enable trucks from the base to drive onto it.

It was then possible for the Navy cargo ship Towle to deliver two shiploads across the dock, completing resupply of the stations for this year. In the past, ships unloading onto the fickle polar ice moored to "dead men"—logs buried and frozen into trenches in the ice. A quick-released arrangement enabled the mooring lines to be cast off from lines attached to each dead man, in case the ice suddenly broke up.

The new dock has been fitted with vertical posts, frozen into the ice, that serve as the counterparts of bollards on a conventional pier.

Antarctic discovery

LONDON, April 26.

British explorer-scientists who have just returned from the Antarctic say that they have discovered a vast area of rich food resources beneath its ice.

Their research ship, the John Biscoe, docked in Southampton yesterday after two years work in the South Polar region, and the team returned with large quantities of marine specimens, including spider crabs and molluscs.

Dr Richard Maitland Laws, director of the British Antarctic Survey, said that vast quantities of plankton were discovered, probably because of the over-fishing of whales in the Antarctic.

"It is still too early to say how vital this discovery is," Dr Laws said. "At this stage all our work is being done in the laboratories, but when the results have been analysed it is likely that man will turn to the Antarctic as a possible source of food supply."

Bacteria Frozen in the Antarctic For 10,000 Years Grow in a Lab

By HAROLD M. SCHMECK Jr.
The New York Times

WASHINGTON, April 29 — Bacteria apparently frozen in the Antarctic ice and soil for at least 10,000 years have grown and reproduced in the laboratory, scientists reported today.

The bacteria were found in permanently frozen sediments at depths of several hundred feet below the surface. About four or five different bacterial types were found, some of which grew and reproduced when put in nutrient fluids.

The leader of the research said the discovery could have important bearing on the prospects for finding life on such inhospitable planets as Mars.

He also said he knew of no no previous authenticated discovery of bacteria even approaching the age of the newly found samples.

In recent years, many scientists have speculated that Mars may once have had a surface environment much more hospitable to life than the dry and frigid desert believed to exist there now. If so, scientists have reasoned, life may have developed on the Martian surface and might still survive, frozen under the present surface.

The United States plans to send an unmanned Viking spacecraft to land on Mars in 1976 in a search for traces of life, but a key unanswered question has been whether or not any living microbe could survive for eons in a frozen state.

The new discovery, announced today by the National Science Foundation, offers important evidence that they might.

"These new results could have tremendous relevance for understanding the ability of microorganisms to remain frozen in a state of suspended animation for hundreds of thousands of years," said Dr. Roy E. Cameron, whose research group discovered the ancient Antarctic bacteria a few months ago.

Indeed, he and Frank A. Morelli, the other senior scientist in the group, have been doing research in the Antarctic sponsored, not only by the science foundation but also by the National Aeronautics and Space Administration's program on ex tra-terrestrial life detection.

None of the bacteria has yet been identified, thus it is not known whether any of them are potentially dangerous to man. It is also not known whether their natural habitat is land or sea, but Dr. Cameron said they were unlike anything found on the surface in the Antarctic regions where they were discovered or in any of the laboratories where they were handled.

He is also sure they do not represent contamination of the samples from which they came. The bacteria were found in cores of sediment extracted by drilling downward in the permanently frozen ground of two Antarctic sites about yp miles apart.

The cores were opened under bacteria-free laboratory conditions. The samples put in nutrient broth — to see what, if

anything, would grow — were taken from the undisturbed centers of the cores. They came from sediment taken from depths between about 250 and 1,400 feet.

Geologists estimated the material in the cores was on the surface of the Antarctic continent at least 10,000 years ago, and perhaps as much as a million years ago. This raises the possibility that some of the bacteria may have been frozen for several hundred thousand years, although Dr. Cameron said it was also possible there were periods of warmth in which the bacteria grew for a time before returning to dormancy.

The report today from the National Science Foundation said the first of the living bacteria were found in a core sample from a depth of about 420 feet near the United States' main Antarctic base, McMurdo Station on Ross Island. Later samples were found there and also in Taylor Valley, about 60 miles northwest.

The research was done last winter by Dr. Camero, Mr. Morelli and State University. The two senior members of the team are associated with California Institute of Technology's Jet Propulsion Laboratory and within Darwin Research Institute, Dana Point, Calif.

In answer to a query by telephone today, Mr. Cameron said some of the bacteria were rod-shaped, some club-shaped and some spherical specimens of these grew and reproduced in the laboratory, he said.

One other type, particularly interesting because it was capable of spontaneous movement could not be made to reproduce.

"We could all see them wiggling when we observed them under the microscope," he said in the statement released by the National Science Foundation, "but conditions were apparently not right for them to grow."

Seals Find Food Down Below

Antarctica's Weddell seals search for food as deep as 1,500 feet below the surface.

The Polar Times

Published June and December by the AMERICAN POLAR SOCIETY, August Howard, Secretary, 98-20 62nd Drive (Apt. 7H), Rego Park, New York 11374

AUGUST HOWARD, Editor

THE POLAR TIMES highly recommends "The Polar Record," published by the Scott Polar Research Institute, Cambridge, England.

The American Polar Society was founded Nov. 29, 1934, to band together all persons interested in polar exploration.

Back issues are 50 cents each.

Antarctic winter stay for women

Jan. 8

The first two American women scientists to winter in Antarctica expect to leave for the ice tomorrow. Both biologists, they are Dr Mary Alice McWhinnie, professor of biological science at De Paul's University, Chicago, and Sister Mary Odile Cahoon, a teacher at the College of St Scholastica, Duluth, Minnesota.

Dr McWhinnie is the leader of a party of four who will study krill, a minute shrimp-like crustacean which teems in the Antarctic Ocean and is swallowed in tons by baleen whales. She has already been to McMurdo Sound five times since 1962 aboard the U.S.N.S. Eltanin and spent a week on the ice in 1971 while the ship was in port. But Sister Mary Odile will be making her first visit and, if she has any free time, hopes to do some ski-ing at Scott Base.

But they do not expect to have much leisure on the expedition.

KRILL FOR FOOD

"Our study will be on the metalbolism and nutrition of krill for information which will be essential for using it as food," Dr McWhinnie said. "It will be a race against time because you never know if you will get back there again. We will arrive in summer, be there through autumn, winter and early spring and during that time the temperature-sensitive krill will go through their seasonal changes, which we must study."

There are seven species of krill, some of which grow up to about 2½ inches long, in Antarctic and sub-Antarctic waters. And, as Dr McWhinnie put it, "they sort themselves out neatly." But there is no way yet of estimating their density.

During the bleak, dark winter when temperatures will probably drop below minus 40 degrees F. and gale-force winds blow, the party will work from the protection of movable "fish houses" under which they will drill holes in the ice to get at krill for experiments.

Dr McWhinnie

In the Soviet Union krill paste and an allied product, cheese with krill paste is being promoted. The Japanese are also interested in krill for human consumption.

A baleen whale will eat about two or three tons of krill a day, it has been estimated. If enormous quantities of the tiny crustaceans are taken from the sea, will the baleen be deprived of one of its most important forms of sustenance?

"At the present time, baleen whales have reduced considerably in numbers (they are self-limiting) and are not grazing down krill," she said. "This an argument for harvesting krill, since they are not being taken naturally."

They make good eating for anyone who likes seafoods.

TASTE LIKE SHRIMP

They taste like shrimp, Dr McWhinnie says. When boiled they turn a reddish-pink, the shell softens and slips off easily. But she does not think krill will ever become a popular table delicacy in the United States. "Americans are not a fish-eating nation," she said.

But lobster and saltwater crayfish are among Dr McWhinnies's favourite foods. She intended to take her party to a restaurant last evening for a crayfish dinner.

Dr McWhinnie and Sister Mary Odile, friends of long-standing, say they are "really excited" about spending a winter in the Antarctic. They are not dreading the cold as they both come from cities which have below-zero winter temperatures.

Sister Cahoon

"For me it may be the warmest winter I have spent," Sister Mary Odile said. "Minus 40 degree temperatures are not unusual in Duluth and we don't have goosedown clothing there like we shall be wearing at McMurdo."

The first American women to spend a winter in the Antarctic were Mrs Edith Ronne, wife of the explorer, Finn Ronne, and Mrs Jenny Darlington, wife of Mr H. Darlington, a member of the 1947-48 expedition.

VAN REETH TO TAKE ANTARCTIC POST

Capt. E. W. Van Reeth, USN, who has been detailed to the National Science Foundation for the past two years, will become Commander of the U.S. Naval Support Force, Antarctica on June 25, 1974. At NSF Capt. Van Reeth served as Associate Manager, Office of Polar Programs. He is succeding Capt. Alfred N. Fowler, USN, who will retire from the Navy on June 30 and report to the Foundation July 1 as Deputy Head, Office of Polar Programs.

Captain Eugene W. Van Reeth, USN, a native of Chicago, Illinois, entered the U. S. Navy in December, 1944, immediately upon graduation from Mount Carmel High School. He served as an enlisted aircrewman, and in July, 1947 was released to inactive duty as an Aviation Ordnanceman. He attended Loras College, Dubuque, Iowa, until recalled to active duty as an Ensign in May, 1951. He served initially as a Communications Officer on the staffs of the Commander, Naval Air Force, Pacific Fleet, and the Commander, Fleet Air Wing Four.

After basic flight training at Pensacola, Florida, he completed advanced multi-engine training at Hutchinson, Kansas, receiving his wings of gold in May, 1954. Following a short tour of duty with Fleet Aircraft Service Squadron ONE HUNDRED EIGHTEEN, Agana, Guam, he was assigned to Patrol Squadron SIX at Barber's Point, Hawaii. While with VP-6 he deployed to the Far East as an aircraft commander of the P-2 Neptune, flying reconnaissance and anti-submarine patrols. Selected for the Navy's College Training Program, he was ordered from the squadron to the University of Michigan at Ann Arbor and graduated in January 1959.

In the early 1960's Captain Van Reeth served at sea aboard the USS KEARSARGE (CVS-33) and the USS HORNET (CVS-12). While aboard the latter vessel he was assistant Operations Officer with the staff of the Commander, Carrier Division SEVENTEEN. While at sea he completed two more Far Eastern deployments.

In late 1962 he returned to Hawaii as a C-121 Super Constellation Aircraft Commander with the Pacific Early Warning Barrier Squadron, flying barrier and anti-submarine patrols between Midway Island and the Aleutian chain. In May 1965 Captain Van Reeth reported to Antarctic Development Squadron SIX, and after serving as its Maintenance Officer, Operations Officer, and Executive Officer, he commanded the squadron from June 1968 until July 1969. He completed four deployments to the Antarctic as an aircraft commander of the C-121 Constellation and the ski-equipped C-130 Hercules aircraft. He then attended the Naval War College, Newport, Rhode Island, prior to returning to Operation DEEP FREEZE in July 1970 as Commander, Antarctic Support Activities. In April 1972 he was ordered to Washington, D. C., to the office of the Assistant Secretary of the Navy (Research & Development), for duty with the National Science Foundation in the Office of Polar Programs. He returns to Davisville, Rhode Island, to become the Commander, U. S. Naval Support Force, Antarctica, effective June 25, 1974. As such he also will be Commander of the U. S. Navy's Task Force ONE FOUR FOUR – formerly Task Force FOUR THREE.

Captain Van Reeth earned his Bachelor's Degree in Industrial Management from the University of Michigan, and his Master's Degree in International Affairs from the George Washington University. He is a graduate of the Naval Post-graduate School (General Line), Monterey, California, and the Senior Course of the Naval War College. He is married to the former LaVonne L. Morse of Mount Hope, Wisconsin. They have three children: Mark, Douglas, and Dana Marie. The family resides in East Greenwich, Rhode Island.

Secrets

By ROBERT C. MILLER

McMURDO STATION, Antarctica (UPI) — With drill bits and helicopters, microscopes and swim fins, man is probing the Antarctic, slowly turning the key to the ice-locked secrets of the world's coldest continent.

More than a thousand scientists, technicians, specialists, and servicemen work under the never-setting Sun of the Antarctic summer in temperatures that often rise to sun-bathing warmth. But only a few dozen continue the "wintering over" work when temperatures drop to nearly 100-degrees-below-zero and hurricane winds tear across the always-dark continent.

During the 1973-74 season, 65 research projects have been started by the Americans, in cooperation with New Zealand, Japan, the USSR, Australia, Norway, and the Argentine. The National Science Foundation (NSF) projects range from studies of the ionosphere to core drillings through the 1,200-foot-thick Ross Ice Shelf. In addition to the nearly $24-million being spent by the NSF, other nations, principally the USSR, New Zealand, and Australia, are carrying out independent programs of their own.

Leon Oliver and his crew of nine New Zealand drillers live in tents and work behind the protection of a plywood barricade as they core drill the mysterious "dry valleys" of the trans-Antarctic range.

The drilling goes on continuously in the wind-swept valleys, which miraculously are free of snow the year round. The frozen drill cores are the first ever taken from hundreds of feet below the continent. They are shipped to scientists at Florida State and Northern Illinois Universities and are giving geologists their first glimpse of the glacial and pre-glacial structures of this section of the Antarctic.

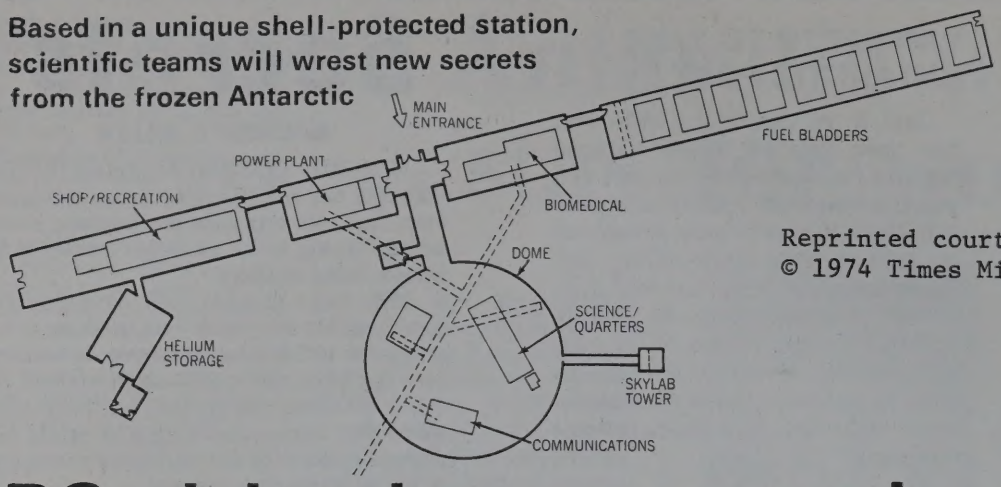
Simultaneously, subsurface temperatures are being taken from the bores along with the detection and measurement of any radioactivity in the penetrated structures.

While Oliver probes the dry valleys, marine biologist Arthur Devries and his Taiwan-born wife, Yuan, are probing the 1,600-foot-deep Ross Sea, where 100-pound dissostichus mawsoni, a cod-like fish that carries its own anti-freeze compound, are being caught and studied. The huge fish have become the gourmet's delight at McMurdo, and its trout-like flavor is delicious.

Dr. Devries and his Scripps Institute of Oceanography team have found that fish living in Antarctic waters have evolved an anti-freeze compound similar to ethylene glycol used in car radiators. They also are working with Scuba teams to scour the shallow areas of the Ross Sea for the marine biological specimens that make the Antarctic seas the world's richest.

Geologists now are convinced that the continent once was tied in with Australia, New Zealand, and South America and probably South Africa. There are coal deposits and other examples of a mild, temperate climate. So far, however, there has been no evidence of mineral wealth in the Antarctic.

Based in a unique shell-protected station, scientific teams will wrest new secrets from the frozen Antarctic



PS visits dome-covered "science city" at the South Pole

By ROBERT GANNON

PHOTOS BY RALPH PAYNE, U.S. NAVY, AND THE AUTHOR

The temperature was -26° F, the air was thin, and I used a half-inch rope to haul myself up. By the time I and my 34 pounds of extreme-cold clothing reached the top, I was exhausted.

But it was worth it. The view was awesome.

I was squatting at the apex of a five-story-high aluminum dome, a silvery knob on an infinite disk of snow—the highest spot in nearly a million square miles. The dome is the most spectacular feature of a strange and unique town taking form in one of the most isolated and inhospitable spots on the face of the earth: a quarter mile from the South Pole.

The view was of an expanse of white—no hills, no ridges to mar the flatness, only wind ripples. No wind now, though, and that was good; at -26° F, the chill factor would create a numbing -68° F from a 15-mph breeze.

The elevation at the dome top is 9236 feet, but the nearest land lies more than a mile and a half away. Straight down. The *effective* altitude is 11,600 feet; because the earth spins, the air envelope bulges at the equator, thins at the pole. Which accounts for my panting.

Off to the side a mile and a quarter away, a mound marks the last view of the Old Pole Station. A radar tower, ventilators, the entrance way still poke through the snow. But living quarters for the 45 men staying there, once on the surface, now lie 40 feet below.

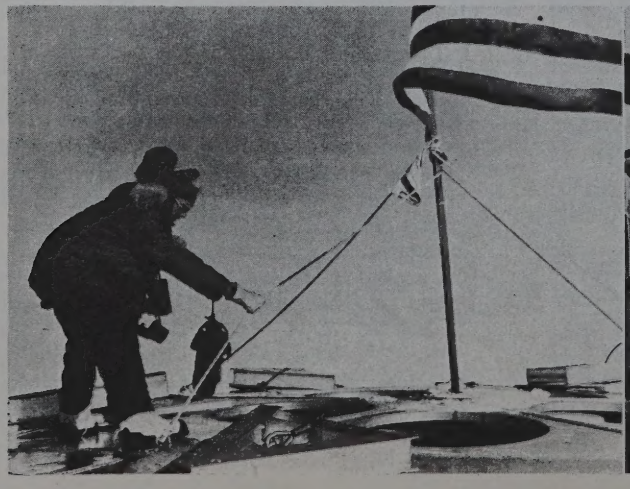
Five hundred feet in the other direction sprawls a small complex of structures housing Navy Seabee and civilian construction workers.

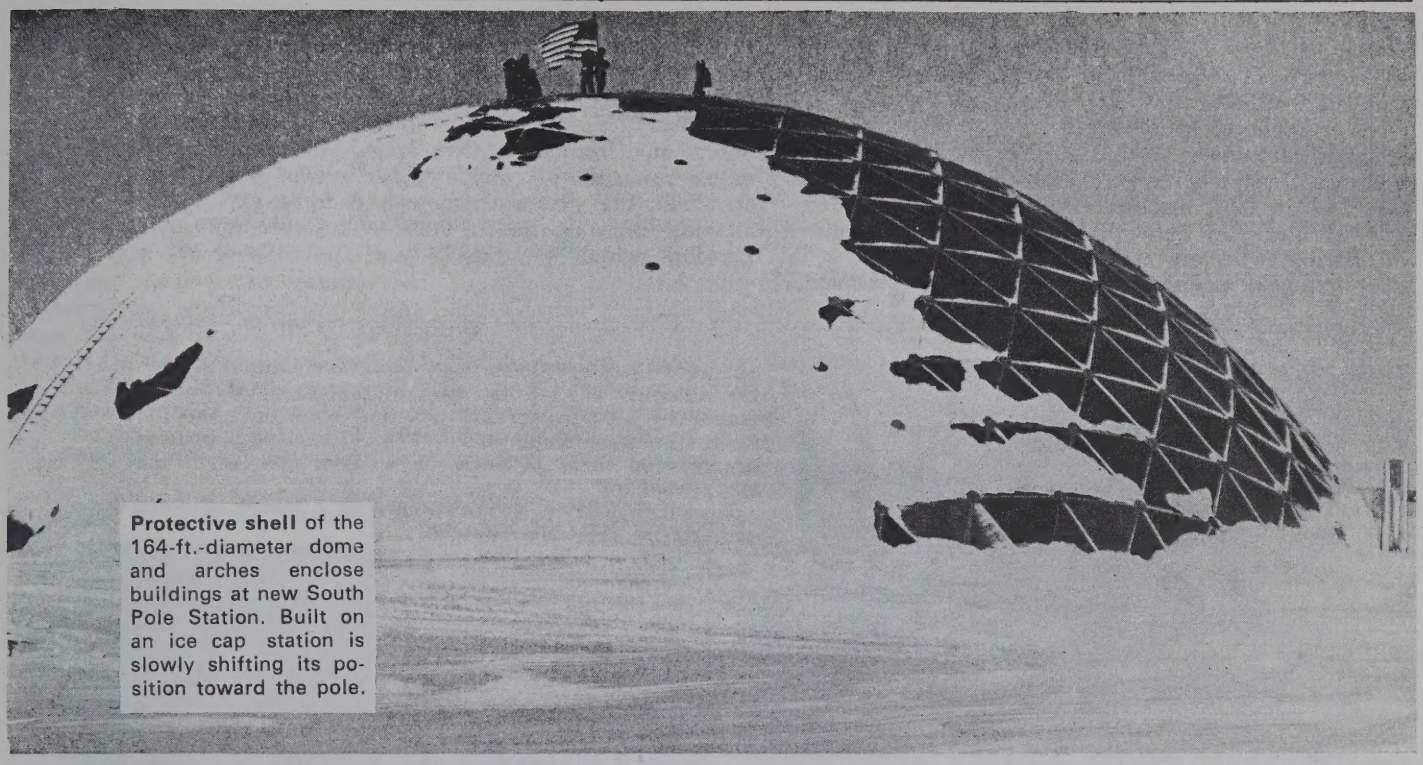
A city within protective shells

In the immediate foreground below, dominating the clutter of packing cases, shacks, tractors, and men, stretch four giant metal arches, like immense corrugated sewer pipes, each 44 feet in diameter and laid out in an 800-foot strip. They look like buildings, but actually they're only protective shells. The buildings are inside. They contain a biomedical research facility, generating plant, fuel depot (150,000 gallons

Atop five-story-high dome, author steadies himself after an exhausting climb in the thin Antarctic air. The dome has an aluminum skin over a framework of aluminum struts.

Cargo unloading is frequent occurrence during the 140-day summer season, when some 231,000 gallons of fuel and 1000 tons of supplies are flown to the polar base.





Protective shell of the 164-ft.-diameter dome and arches enclose buildings at new South Pole Station. Built on an ice cap station is slowly shifting its position toward the pole.

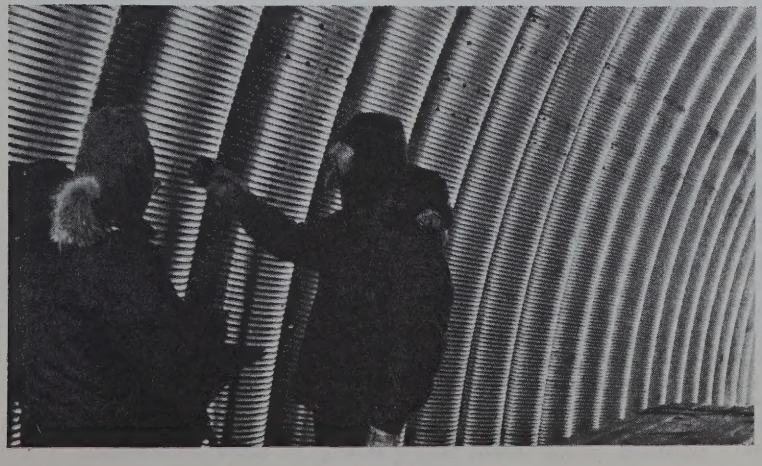
for a whole winter's use), and maintenance shop. Inside the dome are science and living facilities, and a post office, library, and communications center.

The whole complex, underwritten by the National Science Foundation, is an approximately $6-million base for polar research. And the problems that had to be overcome in design and construction were monumental and unprecedented.

Needed: structures that will . . .

- Keep occupants warm when outside temperatures drop to -122° F.
- Hold up under snow loads of 120 pounds per square foot and ice pressures that are squashing Old Pole Station.
- Withstand winds up to 50 mph.
- Be packaged in sections small enough to be transported by plane. Pipes must be superprotected from freezing; bottom insulation is as important as top (so buildings won't melt their way downward). And most supplies must come from Davisville, R.I., nearly 13,000 miles away. Further, the problems of putting everything together at South Pole temperatures become stupendous.

Metal arches also serve as protective shells for buildings. Navy Lt. Richard Carlson, a civil engineer, points out details of arch construction to Gannon.



Other curlicues add to the unreality of it all. For example, the whole thing sits on an ice cap sliding off toward South America at the rate of 1½ feet a day. That's why they're constructing it a quarter-mile upstream from the pole.

And that sun. It really doesn't go down, at least not during the six-month austral summer. Just circles as though lost. And around midsummer, it's not near the horizon, either, as I had thought; it's high, like early afternoon, all the time. Unreal. Take a walk at midnight and you'd think you'd just finished lunch.

The exciting unreality of life at the pole first struck me as our nearly windowless, ski-equipped LC-130 Hercules cargo plane crunched to a stop, the door cranked open, and that frigid air swooshed in. *In my whole life,* I thought, *I'll never go any farther south than this.*

Outside, under an incredible glaring sun, the world was odorless, echoless, and, except for man and his equipment, colored only blue, white, or gray. No animal or vegetable life large enough to see existed in any direction for hundreds of miles.

Inside the construction buildings you notice things peculiar to polar living: no windows, for instance—too upsetting in the summer's perpetual daylight. Bolts going through walls are frost-crystaled, even though some of the buildings are vastly overheated.

The Old Pole Station, 450 feet square, is more permanent-looking, despite the sides crushing in and eerie, hoar-frost-covered passages. The truth is, it was built for three-year use only, back in 1957. But research in the first few seasons was so productive NSF kept on sending scientists back—for 17 years.

Overland convoys

Nowadays all supplies arrive by plane. But back when Old Pole was built, much of the material was

air-dropped. Perhaps as much as a quarter of it (including at least one bulldozer) is still out there somewhere under the snow.

Construction components for New Pole were designed to slip inside Hercules aircraft. Buildings to be covered by the dome and arches, for example, were prefabbed in 52 housetrailer-like vans, stuffed with material and slid into the planes—one per load—with hardly room left for the crew.

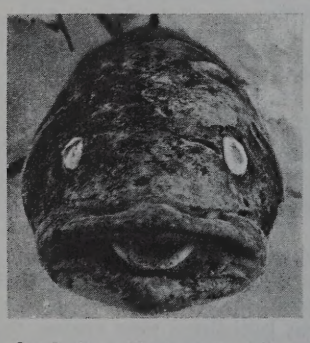
Designing in modules was a problem easily solved. A more basic one is straight architecture: Why a dome and four long arches, anyway? The designers—the Naval Facilities Engineering Command—began by looking at Old Pole's big problem: that crushing. It didn't come from snow, they knew, but from ice. No matter how carefully insulated, some heat would leak out, melt the overhead snow and form expanding, crushing ice, which led to more leaks. Even unheated corridors, which maintain a year-around average of

Stepping off ski-equipped Navy plane, PS contributing editor Gannon is first reporter to visit the remote Siple Station.

Science at the Antarctic—what else is going on

Elsewhere across Antarctica—a continent about as big as the U.S. and Mexico combined—189 American scientists are exploring frontiers in fields from geology to physiology, psychology to upper-atmosphere physics. Of the 65 U.S.-sponsored projects now in the works, here are four typical ones:

● In a tiny hut far out on the ice of McMurdo Sound, Arthur DeVries, 35, of Scripps Institute of Oceanography, La Jolla, Calif., winches a 3/16-inch cable through a hole bored in the nine-foot ice. The cable is a 1640-foot fishing line, and this time he has caught four cod-like *Dissostichus mawsoni* (left), each weighing more than a hundred pounds—bluish white fish with mottled splotches, large spooky eyes, and leering smiles.



The water temperature is -1.9° C, and if you should toss a temperate sunfish or shark into that water, it would certainly freeze solid.

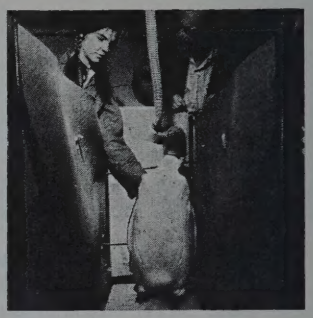
DeVries has discovered why. Dissostichus and other fish under the Antarctic ice have antifreeze in their blood, a large-molecule biochemical called glycoprotein. Next step: determine the antifreezing mechanism, and synthesize the chemical to see if it can be used to preserve such substances as blood, milk, and sperm.

(Dissostichus also happens to taste delicious, as I had proven to me by DeVries' Chinese-born wife, Yuan, who is not only a fine biochemist, but a superb cook.)

● At Siple Station (winter population: four)—the U.S.'s most remote outpost—Jack Bowers of Stanford University sends a 100-kw, very-low-frequency radio signal skyward. It arches up along a magnetic field line to a distance of four earth radii (17,000 km) above the equator, then curves down again to its conjugate point at Roberval, Canada, where sensitive antennae stretch listening.

Bowers and the experiment designers—Robert Helliwell and John Katsufrakis—all of Stanford U.'s Radioscience Laboratory—knew that reception would be good; the antenna is 13 miles long and elevated above the ground by 4000 feet of ice. But they were not prepared for the immense amplification. Power somehow is boosted nearly 1000 times by some mysterious process in the magnetosphere.

Now they're trying to construct a theory, and are wondering if the principle could be applied to other kinds of communications.



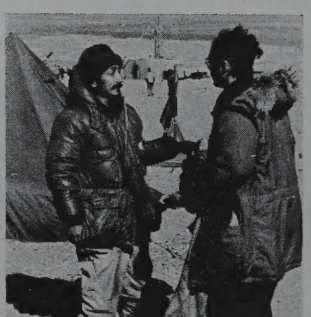
● The 75-pound Emperor Penguin, for some reason nobody understands, walks as far as 80 miles from the sea in the cold winter night to rookeries on the ice. There she lays a single egg, leaves it with her mate, and hikes the 80 miles back to the sea. For two months the male waits, fasting, for her return. Finally, when the egg is ready to hatch, she plods back the 80 miles. And then *he* can head north to the sea for a meal.

How can they walk so far after fasting in temperatures of 50° or more below zero? And why?

In a garage-size refrigerated room at McMurdo Base, Michael Fedak and Berry Pinshow of Duke University measure a fasting penguin's respiration to find out. The penguin is plodding along on a 2½-mph treadmill (above). From a mask slipped over her head, a tube leads to an oxygen/carbon dioxide gauge, to measure, for the first time, a penguin's efficiency.

● Helicopter into one of Antarctica's mysterious dry valleys—polar deserts where the annual snowfall is less than evaporation—and if you don't look at the surrounding glaciers you might imagine you're in the Old West. Until you notice the absence of trees, sage, and life of almost any kind except human.

In Victoria Valley, a drill rig carefully cuts through lake sediment, glacial moraine, and granite, down, down nearly a thousand feet. Scientists of the Dry Valley Drilling Project—a cooperative venture of Japan, New Zealand, and the U.S.—know that the core reveals the valley's history from a time millions of years ago when it was a marine fjord, until today.



One scientist vitally interested is Nobuki Nakai (below, left), a Japanese geochemist from Nagoya Univ. He's trying to prove or disprove his theory of ice ages—that they are caused by the Earth's magnetic reversals.

When reversals occur, he postulates, the Van Allen belts disappear, allowing radiation particles to flood the atmosphere. These ionize free oxygen and hydrogen, forming huge quantities of water vapor. The vapor forms a barrier to sunlight, and the climate cools, perhaps staying that way for 200,000 years, he estimates. Further, the combination of intense radiation and climatic change apparently brings about major biological transformations.

PS visits "science city" at the South Pole

about -10° F, develop hot spots.

The solution: Don't worry about heat leakage; don't think much about insulation (except to save fuel). Instead, put a protective shell overhead to hold the snow off, and blow frigid, outside air between the shell and the buildings. Cut five two-foot holes in the top to let rising heat out, and add a 28,000-cfm blower to pump it along.

Protective shells

"Initially the thought was of just one huge dome covering the whole station," recalls John Perry, former Naval Special Project Officer at the station, now at the University of Washington. "But we ran into problems. First, the scientists wanted as little vibration as possible, so that meant putting the power plant outside.

"Then someone decided that vehicles running in the dome would make too much noise, so the garage had to go outside, too. And there was fuel storage; Navy fire regulations prohibited the bladders being stored under living quarters."

They decided to use arches to house the other buildings, four of them 44 feet high, averaging 180 feet long, and set 30 feet apart. They'd be joined by smaller corridors. The separation was for fire protection—a constant worry.

Steel arches

Such arches have been used before, mainly for aircraft shelters. They're strong—16-inch corrugated steel makes them rigid—and self-supporting, with no internal members, no columns. Ideal.

Before construction began, everyone knew there would be problems, but few realized just how severe. "Take a simple thing like soldering," says Seabee boss Lt. Comdr. William Kay. "When temperatures are really low, it's nearly impossible; the pipe transmits heat away so fast the junctions hardly warm. So sometimes we have to heat up a whole area—drape a covering over us and blow hot air underneath."

Engines ordinarily are kept running continually. But those that have been unused for a time may require three days of heating.

"And then add the altitude effect," says Kay. "You find you tire easily; you're not nearly as efficient. Same thing with machines. A diesel generator that gives us 100 kilowatts of power at sea level will produce only about 30 at the pole; cranes rated at 15 tons can lift only five here."

Last summer the temperature varied between -5 and -87° F, and in severe cold men can work outside for only 15 minutes, then must go back in to warm for 45. With a wind, nobody works; then the chill factor makes life unbearable, and a white-out, Antarctica's answer to the Sahara sandstorm, cuts visibility to that of the thickest fog.

By now, nearly all outside work has been completed, and all inside finishing should be done by January 1975, and the scientists can move in permanently.

Meanwhile, what kind of scientific work will be going on? More than 30 projects are already planned for next year, most in the area of climate. For instance:

- Researchers will measure everything from atmospheric electricity to carbon 14 to sunshine—for world-wide weather forecasting.
- The poles are the "heat sinks" of the world, the ultimate source of cyclones, the principal global climate machines. Basic research here leads to better understanding elsewhere.
- For some reason, earthquakes never occur in Antarctica, so a detection station here makes an excellent observatory for the rest of the world. The area is quiet, too, and because of the pole's location, fixes can be made on *latitudes* of earthquake origins (most stations can firmly fix only longitudes). Last year, up to 20 distant earthquakes a day were recorded.
- Antarctica has no industry, few smokestacks, little homegrown dust, so it makes an excellent baseline for measuring pollutants produced by the rest of the world. If levels increase in Antarctica, the world better be wary.

200° streaking

All of which has nothing to do with a nonscientific activity, unique in all the world, which leads to membership in the 200 Club. Seabee Moose Marino explains: "You sit in Old Pole's steam bath for 15 or 20 minutes, then jump into your boots and run like hell outside to get your picture taken standing naked next to the pole. The difference between the steam bath and outside temperatures must be 200° or you don't qualify." PS

A 63-year battle against the Antarctic

Timber huts built by Sir Douglas Mawson in King George V Land have survived more than 60 years of Antarctic snow drifts and blizzards, a recent expedition has found.

The Minister for Science, Mr Morrison, said yesterday that an Australian Antarctic National Research expedition travelling along the continent's coast stopped to inspect Sir Douglas's main base used between 1911 and 1914.

The base was set up at Cape Denison, 2,000 miles from Mawson, the present Australian main base, and close to the modern French base of Dumont d'Urville.

A party led by Dr D. J. Lugg, of the Department of Science, found that Sir Douglas's main hut, measuring 42ft by 24ft, stood firmly with some of the original horsehair covering still clinging to the walls.

The interior was filled with ice and snow.

Although two smaller huts nearby were in poor condition, a third hut, which housed a magnetometer, was in excellent condition. No snow had entered because its walls were built of tongue and groove boards, lined with tarred paper.

Dr Lugg's party repaired a cross set up for two men who died during an expedition from the base into King George V Land with Sir Douglas in 1913.

They were Lieutenant B. E. S. Minnis and Dr Xavier Mertz.

Rescue ordeal

Sir Douglas' book, "The Home of the Blizzard," explained how his companions died.

Lieutenant Ninnis disappeared with his dog team in a crevasse about 300 miles from the coastal base.

Sir Douglas and Dr Mertz turned back with one dog sled in blizzards and were forced to kill six of their dogs for food. After 200 miles, Dr Mertz died.

Six years ago, two Adelaide doctors published a paper proving Dr Mertz died because he ate dogs' liver, which caused acute vitamin A poisoning.

Sir Douglas continued, suffering boils, festering toes and fingers, and peeling skin all over his body.

He cut the sled in half and pulled it 100 miles back to the base himself. On the way, his boots gave way and he walked with rags wrapped around his feet.

After a month, he reached the base at Cape Denison. Some members of his Australian expedition met him there, but their ship had left for Australia the day before his arrival because the three men had been given up for dead.

Sir Douglas and the expedition members were picked up a year later.

During Sir Douglas's second expedition, the Australian flag was raised at Cape Denison in 1931 and a proclamation claiming King George V Land for Australia was buried at the foot of the flagpole.

Since then, the only visitors to Cape Denison have been an Australian team in 1962 led by the then director of the Department of External Affairs' Antarctic division, Dr Phillip Law, several French expeditions, and two groups of US and New Zealand scientists.

Dr Lugg's party found the proclamation still at the base of the flagpole.

The Sydney Morning Herald, Sat, March 23, 1974

The American Colony in Antarctica

By Jonathan Spivak

MCMURDO STATION, Antarctica—Somehow it seemed incongruous to be explaining Watergate to a Soviet scientist in the Antarctic. But Dr. Leonid Zhadanov, an intense meteorologist, insisted on talking politics. He was as intrigued to find a member of the capitalist press here as I was to encounter a convinced Communist.

But a brief visit to this most remote, hostile and uncharted region of the world is filled with surprises. The National Science Foundation issues each visitor several hundreds of dollars worth of boots, gloves, long johns and other protective garb. Little is needed. The Antarctic summer, just ended, can be as mild as a midwinter day in Washington. Here on the edge of the continent the annual snowfall is less than half that of Wisconsin and none of it accumulates from year to year.

Eight hundred miles inland, at the South Pole, it's easier to grasp the terror of this land's isolation and adversity. Living quarters are buried beneath 35 feet of snow and the temperature hovers at 25 below zero, even in mid-summer. Visitors stay only long enough to have their pictures taken and mail letters back home.

But at McMurdo the living, if not luxurious, is hardly hazardous. Fresh fruits and vegetables are flown in from New Zealand, bad U.S. movies can be seen on base and the PX offers the latest in audio equipment. Life is unpleasant only for a half-dozen penguins, which are being run on a treadmill so their respiration rates can be measured. For whatever reason, scientists want to know how the penguins' metabolism changes with temperature. So the birds are chilled before each workout.

The penguins also suffer other indignities. Constant helicopter flights over their rookeries have interfered with reproduction. The roar of the engines frightens them into trampling their eggs, or leaving them exposed to marauding skuas, the Antarctic gull. But pilots have been ordered to be more careful and the penguin population is now climbing back to normal.

The National Science Foundation, which runs the U.S. research efforts here, worries about other mundane matters. Besides penguins one of NSF's major problems is replacing Seabees and sailors with civilians. The Navy, once the driving force on the continent, has lost its interest in exploration, finding it more convenient to test cold climate equipment in the Arctic. Holmes & Narver Inc., a private contractor, has been hired to finish up Navy construction work, run the mess hall, shepherd scientists around and perform other assorted tasks.

The firm proudly boasts it is the only builder to operate on "all seven continents" and relies on the romantic appeal of the Antarctic to attract workers. Three hundred candidates applied for a handful of jobs last year. College graduates are paid $150 for a 60-hour week washing dishes and construction laborers receive $425, less than the going rate back home.

Once here their excitement and enthusiasm may vanish. There's nothing to do off the job except sleep or drink. "The first day off the plane the adventure was over," complains Ray Clegg, an electrician from Victorville, Calif. Last year, construction workers threatened to strike if their food did not improve and six students who balked at discipline were summarily shipped home by Holmes & Narver.

Actually, the U.S. lacks legal jurisdiction over civilian employes in Antarctica, because it makes no claims of sovereignty on the continent. Thus, there is no way to prosecute violations of the law—indeed no law to violate. Of course, the Navy maintains strict military control over its own personnel and would probably step into the breach for the NSF if a serious incident arose.

However, the foundation is nervous about its absence of authority and is backing legislation that would apply the U.S. Criminal Code to McMurdo and other U.S. operations on the continent. But until Congress acts, Antarctica remains a legal no-man's land. "I worry about it all the time," concedes Emmitt Herbst, Holmes & Narver's assistant project manager for the Antarctic.

Since 1971 NSF has been required to pay the Navy for its services. The two agencies are now negotiating over the cost of operating four military helicopters and five transport planes used for research work. There was less penny-pinching when the Navy footed the bill. Research outlays could be buried in the Pentagon's multi-billion dollar budget and the true expense of Antarctica was probably unknown. "There were a lot of free helicopter flights then that don't exist now," recalls Mike Mudrey, a young geologist from Northern Illinois University. Back then, a two-star admiral was assigned to Antarctica, with quarters in both Washington and New Zealand, and the Navy began building a showpiece station at the South Pole.

Now the highest ranking military officer in Antarctica is Captain Alfred N. Fowler and plans for the pole station have become far less grandiose. NSF insisted on reducing the scope of the facility to its more modest scientific needs. Capt. Fowler spends much of his time trying to figure out how to curtail other costs and eliminate unnecessary operations. Last year the Navy relinquished control over Palmer Station, a small outpost, and eventually it may shed most of its Antarctic assignments, except air traffic control. But the captain figures one challenging new task would be operating a nuclear submarine beneath the huge Ross Ice Shelf, to help scientists study primitive life in the abyssal depths and probe the geology of undersea sediments. Washington does not display much interest. "We do feel very definitely out of the mainstream," he concedes.

The real enthusiasts for the Antarctic are scores of scientists who eagerly examine its rocks, ice cap, atmosphere and animal life. Some started to come here more than a decade ago as graduate students and are now professors, supervising a new generation of Ph.D. candidates. They hail from such institutions as Nebraska, West Virginia, Virginia Polytechnic Institute and Florida State and drill holes through the ice shelf, hunt hardy microbes and count cosmic rays, among other activities.

One suspects that by nature these are solitary, self-sufficient men who enjoy physical and intellectual isolation. They spend much of their time carting equipment around and waiting for planes to depart. Months of effort may be devoted to assembling all the items needed in the U.S. because there is no way to buy spare parts or replace defective equipment in the Antarctic.

Most scientists stay only during the polar summer, when 24-hour-daylight makes research most rewarding. But the constant sun can be disorienting; it provides no cues for sleep or signs to mark the passage of time. The result is a tendency to stay awake until one drops from exhaustion.

A handful of researchers remain through the unrelieved months of winter darkness, when the continent is completely isolated. Ham radio stations link those stationed here with friends and family back home. Only in an extreme emergency will Navy planes risk rescuing sick or injured scientists.

This year, for the first time, two women scientists are wintering over at McMurdo, and the Navy also stationed its first female officer here. (Her presence precipitated a minor crisis, because bathroom facilities had to be divided with a larger contingent of males). Barriers will continue to drop under NSF. "Sooner or later it had to come," concedes Joseph Fletcher, director of the foundation's Office of Polar Programs.

But the bigger issue which confronts NSF is whether research here is worth the hazard and expense. Much of the $25 million annual cost is devoted to transporting men and equipment to Antarctica. There is no question that U.S. political prestige is a major factor in maintaining a physical presence in Antarctica—just as it was in flying men to the moon. The Russians run a similarly ambitious program and are currently ringing the eastern part of Antarctica with scientific bases—no one knows exactly why.

Researchers insist the scientific opportunities are unique. Cosmic rays evade the barriers of the earth's magnetic field; radio waves originating from here travel all the way to Canada; the upper atmosphere suggests world-wide pollution patterns; ancient rocks and fossils reveal the geologic history of the southern continent.

But one suspects the scientists are spurred most by a sense of excitement and adventure. They come to Antarctica, just as reporters do, to satisfy their curiosity and the urge to explore. The trip is personally worthwhile, even if nothing of significance is discovered.

The NSF is currently seeking to emphasize the practical potential in Antarctica and impose a more rational and rigorous order of scientific priorities. But it may not really make much difference.

For just as in the space program, technology and politics sustains the Antarctic research program. Science is secondary.

Mast High to Growler a Frozen History

by **Mary P. Goodwin**

Photo by Mary P. Goodwin

The air is full of wind-driven snow. Along the ground rounded ice-hard particles scour the packed surface into linear grooves. Above, fine ice crystals condense in the barely moist air of the blinding sunlight. They mix with the blowing snow. A high whistle is deafening. It is 55° below zero. The 14,000 foot plateau is white and barren. A man cannot stand here against the force of the wind; breathing would freeze his lungs. It is the center of the Antarctic continent and this is where the ancestral iceberg begins its life.

The polar ice cap in central Antarctica averages 12,060 feet thick and a New Zealand team recently calculated a 15,870 feet thickness near the Soviet interior station of Vostok. The ice rests on bedrock, pressing it down to 6500 feet below sea level. This snow and ice has been accumulating for up to 33,000 years at the slow rate of three to four inches per year. Since it never melts, here has grown the world's largest ice sheet.

Draining this great continental mass of ice are ice streams within the northward and downward flowing ice sheets, outlet glaciers, valley glaciers, ice shelves and floating ice tongues. The circumpolar weather is responsible for the build-up of ice, for the newly-condensed snowflake, the snow reshaped into ice dunes called barkhans, and sastrugi, wave-like ridges of hard snow. It is responsible for the movement of the glaciers, the drainage from the flow centers of the high plateau, and for the distribution of shelves and pack ice around the periphery of the continent. The enormous ice plateau in turn affects the weather over the whole southern continent.

The Antarctic is a radiative heatsink. The ice-cap with its brilliant white surface acts as a broad mirror, reflecting sunlight, dissipating more heat than it receives. Much of the heat transported towards the Pole in the oceans is also lost. Storms along the coast force warm moist air to rise and heavy snow accumulates over the mountainous edges of the continent. But these storms do not usually reach the interior. The clear skies and dry stagnate atmosphere of the high plateau allow a vast amount of heat to escape and make the central ice sheet one of the coldest places on the earth. (A measurement of 126.9° below zero has been recorded.) Inland, the temperature does not rise enough in the summer to melt the snow. Surface ice is rare. Instead, the snow is constantly shifted by the shrieking wind, added to by the meagre three to five inches per year, and gradually hardens into a light porous mixture called firn. As the weight of more snow over the years increases, the firn is compressed into ice far below the moving surface. This ever-increasing thickness of the ice provides the southern waters with an endless supply of icebergs, many hundreds of miles away, and thousands of years in gestation.

Drained of all moisture, the cold air settles and katabatic or descending winds of up to 135 miles per hour force it down the slopes of the continent, where it again becomes part of the circumpolar cyclonic winds. Picking up moisture once again, the process is ceaseless.

The direction and rate of the ice down from the polar plateau is determined by the subglacial topography of the land both above and below sea level. A mountain ridge buried far below the sea will act as a dam, over which the mass of ice must compress and lift as it passes towards the coast. The continent is crossed by two long and high ranges of mountains, the highest, the Vincent Massif, rising to 16,860 feet. These are barriers also to be circumvented. There are numerous smaller mountain systems, ice domes, and isolated mountain tops called nunataks. Wide ice rivers slowly wind through and around these land boundaries. They move north, checked, released, deformed. They converge, change direction, surge. Some are confined forever behind high palisades, some end abruptly in vertical cliffs at the sea, and some spread out finally into broad shelves of grounded or floating ice. (One of the largest of these is the Ross Ice Shelf. As big as Texas, it is 500 by 400 miles wide.)

Our iceberg, as yet unformed, is buried within such a mass of floating ice, 1000 feet thick and moving seaward at the rate of one quarter mile per year. It will take about 2500 years to get there.

Many people think of an ice field as a white desert, without life, a place of almost perfect silence, perhaps of awful

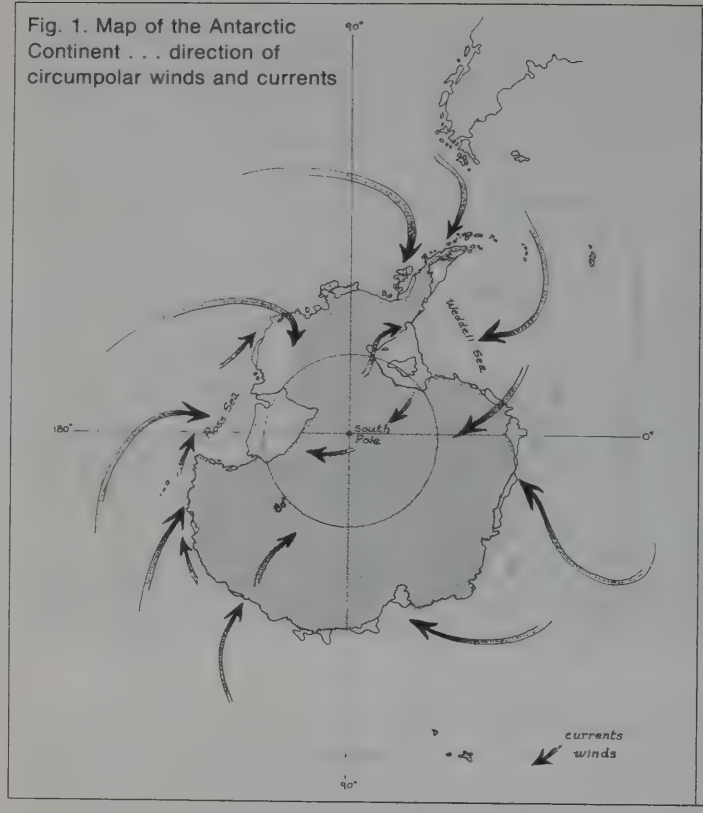


Fig. 1. Map of the Antarctic Continent . . . direction of circumpolar winds and currents

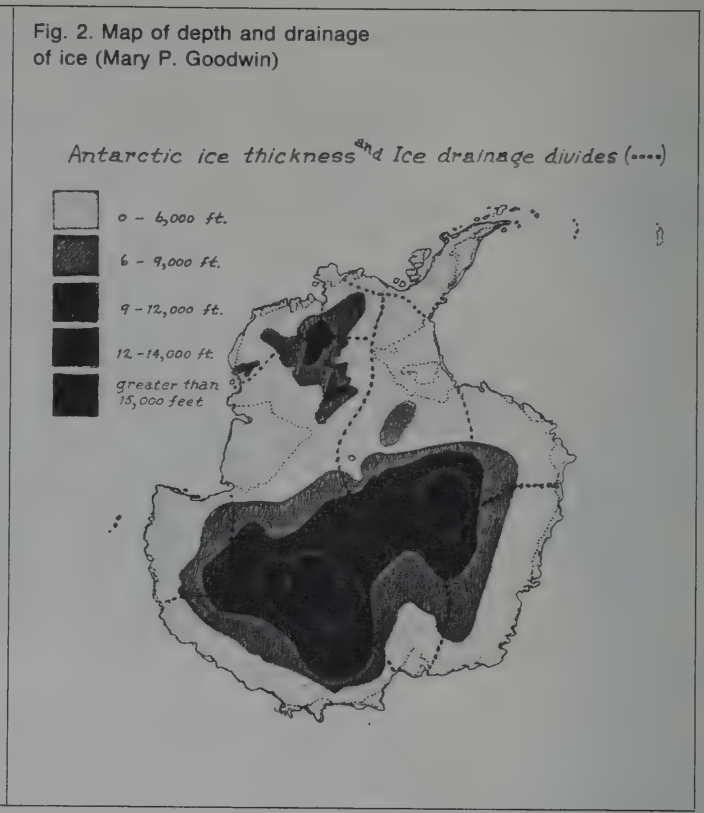


Fig. 2. Map of depth and drainage of ice (Mary P. Goodwin)

grandeur. Of life there is none. But a close look will show a variety of movement, fine details, and almost never complete silence. On an occasional day still air, diffuse daylight, and condensing moisture combine to form a 'white-out,' land and sky indistinguishable. But even then ice prisms, needles and columns and plates of tiny ice particles, move against one another with a glimmering sound. Crevasse systems develop as the glacier moves over and around the bedrock topography, upward pressure ridges tumble crumbling ice blocks against one another. Breakable crusts form during radiation, an iced popcorn surface may develop, meltwater races and potholes form, the water changing course and deepening to the lowest level. Wind redistributes the snow and glaze into long sastrugi. As air from the original snow layers escapes it hisses with an almost human sound. Deep rumblings come from far beneath the surface as the firn compacts. These readjustments of levels create earthquake-like shocks; the ice actually shakes. Ice may be as hard as steel or drift-like powder. It is coarse and granular, delicately laced, an ensemble of blowing, scouring, super-cooled drizzle, fissured. It is bridged with soft new snow. It is bare and blue or brilliant red under the short winter light. It will shatter like fragile glass or bend like rubber.

If we have dug an imaginary pit and stained the sides with ink, or taken a core of ice from a deep drill hole we can read the frozen history. The record of thousands of years of Antarctic climate fluctuations, sudden meteorological changes, past events of man, all are there. There will be density differences, disconformities of summer and winter layers. Ancient wind-borne snow shows as rounded compacted layers, hundred-year-old crusts are identified by old lines of condensation along the bottom, a fuzzy evaporation layer above. Precise cross-bedding tells of changing surface angles. Decayed layers of tiny particles reflect fallout from the Krakatoa explosion in 1883; the 1963 stratum accurately coincides with the eruption of Bali's Gunung Agung. If we measure the relic radioisotopes at the 1961-62 level we find the mark of thermonuclear tests. Interspersed will be veined grains of old morainic material carried from the slowly eroding mountain ranges. The embryonic iceberg buried within the ice moves toward the ocean reflecting all of yesterday.

At the junction of the continental and floating ice is a strand crack. Here the water-borne glacier begins. Small shelves fringe the continent. But within one of the two largest, the Filchner and Ross Ice Shelves, our incipient berg has still 500 miles to go. Travelling steadily now in its massive raft, it approaches its birth in the polar waters. With glacial ice added at the southern end and bergs calving in the North, the ice shelf maintains its shape and size although dramatic events do occur. The entire Polar Record Glacier, part of the Amery Ice Shelf, seems to have catastrophically calved at its landward hinge in 1964. The total area lost from the shelf was 10,920 square miles. The next year a state-sized tabular berg was spotted from the air, the same size *and shape* as the missing piece, and in the exact position where the currents would have directed it. Giant bergs of 300 to 400 miles long are often encountered near the coast, presumably the leading edges of the larger outlet glaciers, small shelves, or ice tongues. Ice shelves exist, flexing, supported by the coast, protected by the shores of large bays. They are rapidly destroyed at the leading edge as icebergs calve continually.

Shelves have a gentle rolling, crevassed, or level surface and a sheer outer edge. As in the far interior there is still no life, but petrels, amazingly, are sometimes seen flying south above them. No one knows why. Occasionally fish or seal remains appear on their surfaces, inexplicably. There are two theories

about this phenomenon, together with speculation about the ice balance at the bottom of a shelf.

Sea ice may adfreeze to the underside of an ice shelf, shallow water organisms may work their way through to the surface (Debenham, 1911). Radiocarbon testing has shown one mummified seal found far inland on the ice shelf to be 1100 years old! Another and more recent theory is that ice shelves melt on the underside, gradual heating occurs in the ice as it moves north and also with increasing depth within the ice. Since the water temperature underneath is always less than the shelf, heat may move up through the ice.

It has been a staggering number of years. Within this huge raft imperceptibly moving up and down on its hinge our iceberg is approaching the brink, finally about to be born.

Waves smash at the base of the wall of ice. Plumes spray high over the ice foot. Rumbling rhythms issue as the waves carve deep holes into the ice. Water cascades from the crenellated top. Linear wedges of ice lean out precariously, 150 feet high, unstable pickets, all that's left of ancient crevasses. The face of the cliff is a criss-cross of ice held together tenuously by the still-solid underwater part of the outer shelf. A deep crevasse works free at the back. It splits to the water line. In slow motion the mass of ice detaches itself. With a ripping roar it topples onto its side, sinking deep into the water. Up it slowly bobs, pushes deep again and reappears. It comes about, rights itself, rocking, pulsing, sucking at the frothing water. The behemoth slowly comes to rest in its own cleared ring. Old sea ice blocks rock on the perimeter of patchwork floes. Calving, the berg is an entity.

Now come the birds, from all along the barrier, petrels, fulmars, giant skuas, to feed on the fish and disturbed plankton. Life at the ocean bottom is also stirred by this enormous delivery. Dipping and wheeling, the birds gorge from the sea. Some come to rest on the new white giant, others fly to feed the downy young on nearby rocky coasts and low ice piedmonts.

Icebergs come in all sizes. There are towers, battleships, rooted molars, floating prairies. The two largest measured by the United States Navy were 100 miles long by 130 feet high, and the other 208 miles long, 60 miles wide and 130 feet high. The bergs calving each year in the Antarctic contribute about 520 cubic miles of fresh water to the Southern Ocean. As well, they add a tremendous amount of cold. Average berg temperature ranges from 50 to 75 below zero, whereas the water in the Antarctic is never colder than 28 F.

Crevasse system of interior ice.
Photo by Eugene L. Boudette, U.S. Geological Survey

Unlike the icebergs of the Arctic which are usually calved from glacial snouts and have a cathedral-like shape, almost all of the bergs of the South are tabular. From above they are hatched with crevasses, from the side they are linear, and from below they are mellow, hollowed, pendulous. They may have projecting rams just beneath the water line, the result of wave action and often a hazard to the old wooden ships. Today's sonar and radar warn of bergs, their exact size and shape, even in the dense fog or winter darkness. Included within the icebergs is all that has slowly worked its way out from the interior of the continent. In at least two instances, remnants of Admiral Byrd's former camps have been seen. High on the side of one long berg were radio antennae, supply crates, and draped pieces of a tent—Little America buried and sheared in two and now, forty years later, drifting to eventual deposit on the floor of the sea.

The iceberg belongs now to the sea. It moves with the currents flowing westerly around the continent. In winter it will be immersed in the pack but not a part of it. The sea ice moves with the winds, generally easterly. The berg with its great depth is pushed with the current; it often seems to be sailing in the opposite direction from the movement of the pack ice. And so it may be, plowing a perverse swath, piling up crumbled hummocks into long trailing ridges. It will travel through dense fog where the cold and warmer currents meet. It will drift slowly through open water pools called

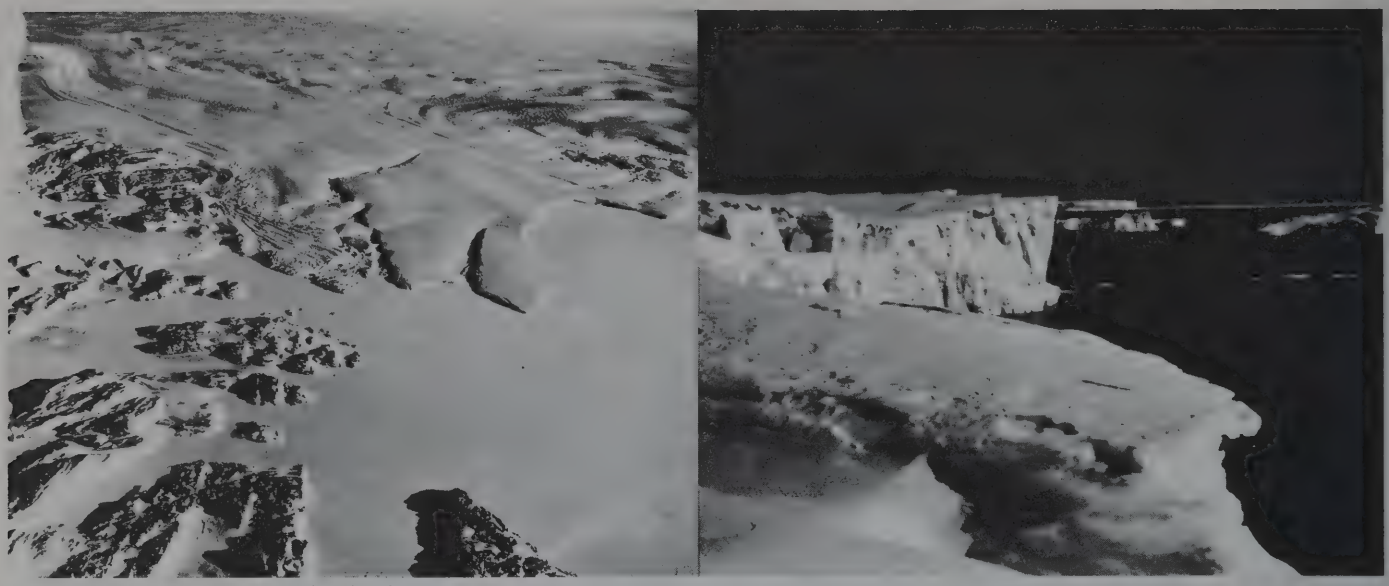


Fig. 3. Edge of the Continent showing ice movement and berg almost at the moment of breaking. Anare photograph by "Aerial Photograph" Ice Barrier. Photo by Eugene L. Boudette, U.S. Geological Survey.

polynas. It will cluster with other bergs subject to the same force. It may become embayed, grounded, dig into permanent harbor, then careen and subside into a pile-up of shore ice.

Salt leaches slowly through older bergs until the slush at the top is quite fresh. This was a frequent source of drinking water in the heroic days of exploration. A tiny wooden ship would anchor with a 'deadman'. All hands scattered with buckets and shovels, lined up, and resupplied the ship with clean ice to be melted in great barrels in the primitive galley.

Dark bands of rock dust hasten the uneven melting. The berg will tilt at a crazy angle, a white cuesta in a dark green desert. It is carved and polished by the wind, sculptured at the water's edge into gutters and caves. Eventually it collapses on its side or overturns and the process of attrition starts again. When a berg rolls over you have a grand view of what has been happening far below, eroded ice, up-ended strata, lovely red and purple streaks of the ice algae, and, if the berg has been long in shallow water, all the inclusions gathered into the ice from the bottom gravels.

If the berg moves with the pack circling to the north it makes its escape from the Antarctic. Reflected now in deep blue waters, it melts into a gently domed shape, divides into mini-bergs; circling and weathering irregularly they become a congregation of 'bergy bits' and the white mountain is gone.

Our iceberg, however, remains close to the coast. In the glittering sunshine of summer, birds circle it and penguins march along its precariously jumbled ice foot. In gangs they dive and porpoise. Weddell and Ross seals are below too. As the winter darkens all but the great emperor penguin leave the Southland, rafting north on the old sea ice to feed in the rich plankton-full waters of the Antarctic convergence. New pack ice freezes heavily around the berg. Seals gnaw the edges of their breathing holes. During the long night an occasional emperor passes on his way to an open lead to feed. He returns, alternately walking and tobogganing. On the shore rookery he will relieve his mate in their wintry process of incubating a single egg.

In the spring the tiny Wilson's Storm Petrel returns first. Other flying birds, raucous, throaty, mottled Cape pigeons, ugly giant petrels. And then, homeward bound Gentoo and Adelie penguins line the distance with dots across the pack ice. Bull sea elephants herd their snuffling harems to shore. The ice tower has softer contours now. It is smaller and listing badly. Disguised with windward and leeward snowdrifts it is brilliant pink in the low lying sun. Turquoise ledges and weathered rams sparkle below a deep wave cut. Now as the sea ice releases it, the berg moves out of its small bay, in again, and out; moves west along the coast into another haven. Its shape and girth have changed. As its depth diminishes it moves less surely with the currents, vacillates and slows. Once again in the fall it is fast in sea ice and takes up a position below towering black rocks newly capped with snow. Larger, newer bergs pass by, cleaving the pack.

At the beginning of the third summer the giant is fragmented, sunk at angles. The several bergy bits are milling the rotten sea ice, eddying free under the returning sun, higher each day. They roll about, awash, lower each day in the water. They are the smallest glacial remnants now, 'growlers'. Their tops are pooled with meltwater, thin streams score their slanting sides. They are blue and green and gold during the lengthening day, violet or scarlet in the short nights. Here rest sleeping seals, and Adelie penguins escaping the dread leopard seal stand watchfully.

Sunlight glances. A sleek steel ship's bow softly bumps. The penguins hurriedly dive off, the seals only raise their heads as the great hulk glides by. In a month of circling, drifting, melting, fragmenting, the growlers become brash ice. The iceberg is gone, vanished in a froth of fragile slush, tossed by the smallest wave.

Mary P. Goodwin has written travel articles and essays for children about the Antartic. Her passion for that icy world is apparent in this poetic article, her first, for TERRA. She is a well-known medical illustrator and the drawings and charts are her own.

TERRA
The Quarterly magazine of
THE NATURAL
HISTORY MUSEUM
of Los Angeles County
VOL. 11/NO. 3 WINTER 1973

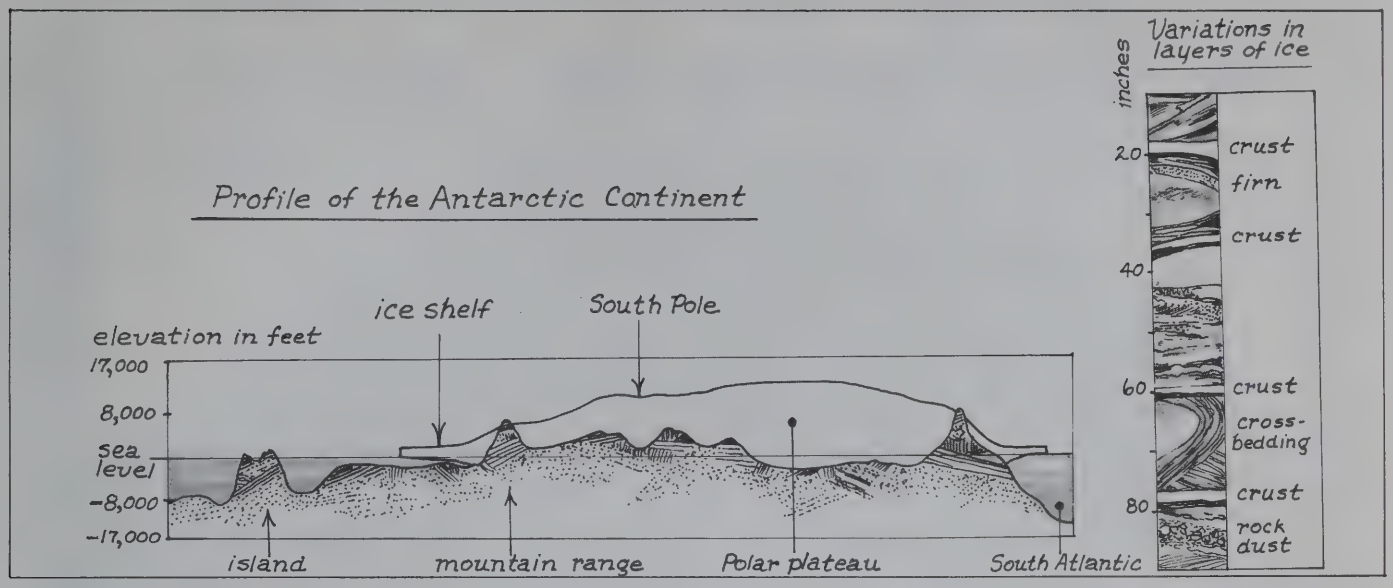


Fig. 4A. Continent . . . saggital

Fig. 4B. Interior of ice cross section, stained (Mary P. Goodwin)

Fig. 5. Layered ice cliffs . . . ANARE photography by "A. Campbell-Drury"

Fig. 6. Helicopter view (1963) of iceberg containing remains of Little America III (1939), 300 miles at sea. Photo by U.S. Navy

Growler . . . with Underwater Ram (Charles Swithinbank)

A Continent for Science

Research in Antarctica

Geodesic dome at new U.S. South Pole station Kendrick Frazier

Science News, 1719 N Street, N.W.
Washington, D. C. 20036

by Kendrick Frazier

At 5:39 a.m. Dec. 10 a new ski-equipped LC-130 Hercules transport plane purchased by the National Science Foundation only 20 days earlier touched down on the open snow at the newest and most remote U.S. scientific station in Antarctica, reversed its props and slid bumpingly to a halt.

Inside the aircraft, atmospheric physicist Theodore J. Rosenberg and three University of Maryland colleagues were rejoicing. They and some 11,000 pounds of their scientific equipment were at last at Siple Station. After a year's delay, they would be able to begin their two-month project to launch high-altitude balloons with counters to measure X-rays produced by electrons streaming down from the atmosphere above Siple.

A year earlier, they and their equipment had three times made the same 1,550-mile flight. But each time bad weather had prevented a landing, and they had to turn around and go back. By the time the weather had cleared, too little time was left in the season. The project was scrubbed for one year.

Antarctica is the coldest, windiest, most inhospitable place on the surface of the earth. Scientists who come here to do research must do so on the continent's own terms. It sets all the ground rules. Its vast distances and harsh environment establish strict limits on the duration, location and extent of the research.

Yet despite these conditions, 175 U.S. scientists are in Antarctica during these months of the Southern Hemisphere summer studying the ice, the land, the air, the water and the life in, on and around the frozen continent. Technicians and Navy logistics support personnel swell the number of Americans in Antarctica this summer to perhaps 1,000, all participating in or aiding the U.S. Antarctic Research Program, conducted by NSF to the tune of $7.5 million for research grants and $16 million for logistics support. Counting the scientists and support personnel of all the nations with research programs in Antarctica, the total population of the continent this summer is about 3,000. All of them are here on behalf of scientific research.

What is this fascination with Antarctica? What does such a cold, formidable place have to offer science? The answers are almost as numerous as there are fields of scientific study.

To climatologists and glaciologists, Antarctica is a history book of past world climate. Locked in its cover of ice, which in places is nearly three miles thick, is a record of temperature variations over the surface of the earth for hundreds of thousands, and even millions, of years. Antarctica, still in an ice age, thus holds many secrets toward understanding the ice ages of the past that affected vast areas of the earth, and perhaps ice ages of the future. The continent contains 95 percent of all the permanent ice in the world. Whether the ice cap is growing or shrinking is a question of vital long-term importance. If just a fourth of it melted, sea levels throughout the world would rise 50 feet, and many coastal cities would be threatened.

To meteorologists, Antarctica is a weather factory for the entire Southern Hemisphere. Warm air flows south toward Antarctica, cools, descends, and flows back toward the tropics, setting up a global circulation of the atmosphere. The fierce weather of Antarctica is an object of study in itself. The coldest temperature recorded on earth was at the Soviet Union's Vostok Station—a minus 126.9 degrees F. on Aug. 24, 1960. The winter of 1973 was considerably warmer. The temperature dropped only to minus 115.6 degrees F.

Winds of 100 miles an hour are frequent along the part of the Antarctic coast facing Australia.

To marine biologists, the waters around Antarctica are the most biologically rich in the world. Cold water sinking to the ocean floor causes upwelling of nutrients to provide abundant food for the entire chain of sea life.

For zoologists, the seals and penguins that live on the sea ice and the fish that live in the ice water below it are a source of endless studies of biological adaptation to extreme environmental conditions.

To the microbiologist, the bacteria and other microorganisms that tenaciously cling to life where soil and rock are exposed hold clues to how primitive organisms might exist on other planets, particularly Mars, whose climate is similar in many ways to that of Antarctica. In 1968, biologists found microorganisms in the southernmost exposed soil in the world, on Mt. Howe, 160 miles from the South Pole.

To ecologists, the fragile and simple ecosystems of the small lakes in the ice-free valleys of Antarctica are natural outdoor laboratories for the study of the relationships between organisms and their environment. Scientific groups at Lake Bonney this year are studying the metabolism of the lake's aquatic organisms, including an entire community of life that lives in conjunction with a mat of algae attached to the sediments on the lake bottom. Says one biologist, "They're studying everything in the lake, and trying to relate all the factors in the system. Practically every day they're discovering another species of organism."

For environmentalists, Antarctica, far from any sources of local industrial pollution, is an ideal place to monitor the degree to which pollutants have spread throughout the entire global atmosphere. This year at the South Pole the National Oceanic and Atmospheric Administration has set up one of six "clean air" geophysical monitoring observatories that will make long-term measurements of carbon dioxide, ozone, particulates, and solar radiation. Other instruments are measuring trace elements in the Antarctic atmosphere.

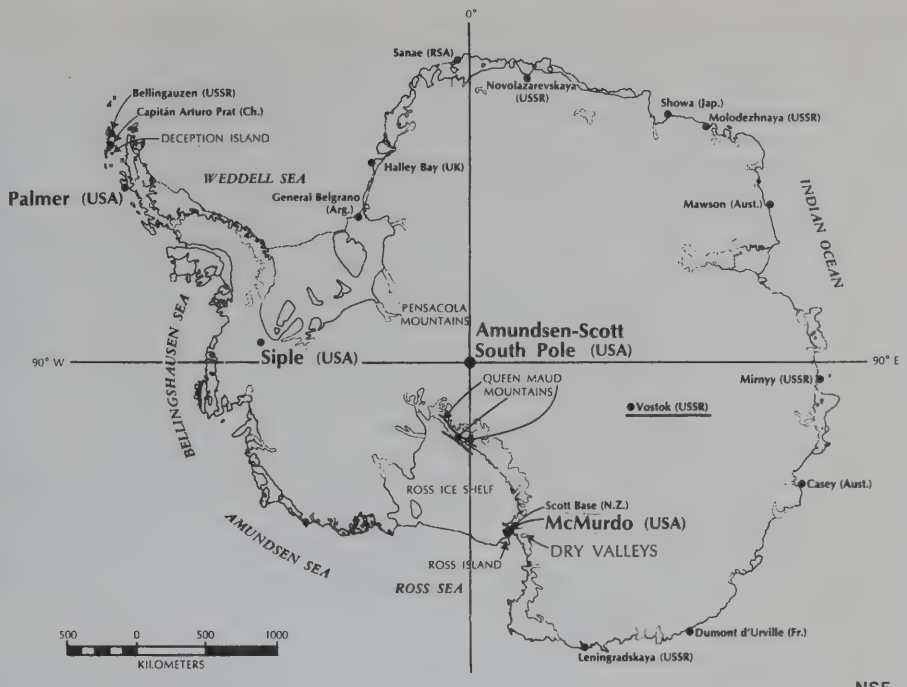
To geologists, who this summer are conducting the first scientific drilling into the continent itself, Antarctica holds clues to a better understanding of sea-floor spreading and continental drift. Antarctica was once linked to Australia, India and Africa.

And to geophysicists, Antarctica is a unique place where magnetic field lines reach down to the earth's surface, allowing low-energy cosmic rays to penetrate the atmosphere and setting the stage for a whole array of studies of the planet's electrical and magnetic properties. Siple Station, for instance, is located at one end of a magnetic field line that arches far out into space to a distance of four earth radii (17,000 kilometers) above the equator, then curves back down to earth at Roberval, Quebec, Canada, where there is a similar observation station. Scientists at Siple use a 100-kilowatt transmitter and a 13-mile-long, very-low-frequency antenna spread out above the snow to send signals up along the magnetic field line and back down to Roberval, where they are examined to see how the upper atmosphere alters them.

In 1973, for the first time, Siple was operated throughout the winter. The scientists discovered that the signals they sent up were amplified in power 1,000 times by some unknown process in the earth's magnetosphere. "This was the first time that it has ever been proven that a transmitter could send up radio waves and have them amplified," station leader Jack Bowers of Stanford University told the only group of reporters ever to visit Siple, in December. The phenomenon could foreseeably have communications applications in the future.

* * * *

Scientific research is not new to Antarctica. When Robert F. Scott and his four men died in 1912 on their way back from the South Pole, they had with them 30 pounds of rocks collected along the way for their scientific interest. But the first full-scale scientific effort was the International Geophysical Year of 1957-58, in which 12 nations



NSF

Research stations of the United States and other nations dot Antarctica.

A continent of contrasts

To the visitor, Antarctica is a land of often dramatic contrasts. The continent holds 7 million cubic miles of freshwater ice, yet it is a desert; annual precipitation ranges from 2 inches at the South Pole to less than 2 feet in coastal areas on the northward-jutting Antarctic Peninsula. Ice covers some mountain ranges so thoroughly that only the tops of high peaks are exposed, yet there is an extensive area of completely ice-free valleys covered with coarse sand and speckled with lakes and streams.

The continent itself is nearly devoid of any but microscopic plant and animal life, but the teeming waters around Antarctica are the most biologically abundant on earth.

It is the coldest continent on earth, yet all the buildings at U.S. research stations tend to be needlessly overheated. Pilots find flying in Antarctica challenging at first, but many admit to being soon bored by the monotonous terrain of unrelieved snow and ice.

A blizzard that strikes during the six-month Antarctic night can be almost unbelievably bitter, yet a calm, sunny summer day in January during the period of perpetual daylight can be far more pleasant than what millions of winter-bound Americans are experiencing at the same time in the United States. Depending on one's situation, Antarctica can be awesomely beautiful and peaceful or terrifyingly formidable and hazardous. —*K.F.*

joined in an all-out assault on the scientific secrets of the frozen continent. The years since the IGY was planned have seen an enormous advance in the scientific understanding of Antarctica.

"We've taken an unknown continent and made it known in 20 years," says University of Nebraska geologist Samuel B. Treves, who himself has made seven trips to Antarctica.

This is the age of systematic scientific study in Antarctica. Research now focuses not so much on *what* is there, but on the *why* and the *how*—and what it all means for the rest of the planet.

With the help of modern aircraft, modern communications and experienced support personnel, scientists now can use Antarctica as an extension of their own laboratories. They are well-fed, well-clothed, and well-cared-for—one logistics aide admitted they might be "a little spoiled." Temporary field research camps are heated with oil stoves or furnaces, and even tents are usually fitted with plywood floors. But everyone seems to realize the goal of such comfort is efficiency—to allow the scientists to spend as much of their time as possible doing research.

The largest project under way to make living in Antarctica easier is the construction of a new U.S. station at the South Pole. The existing Amundsen-Scott South Pole Station, first occupied in 1957, shows scarcely any evidence of its existence to the visitor to the South Pole. Over the years it has become deeply buried by the blowing snow and the only things protruding above the surface are ventilator pipes, chimneys, and a small plywood entranceway through which one enters the station by way of a long sloping tunnel. The station is succumbing to the fate that eventually dooms all habitations in the interior of the continent—crushed under the weight of the blown snow.

The new South Pole station consists of two large exterior snow shields—one a 52-foot-high geodesic dome, the other a metal semi-cylinder 800 feet long and 46 feet wide. The dome houses three prefabricated buildings that will be the main living, sleeping and laboratory areas for up to 50 persons. The long tube houses fuel (150,000 gallons have to be left before each winter), vehicles, generators and some laboratories.

Capt. William Kay, head of the Navy Seabees in Antarctica, calls the building of the new South Pole station "the most challenging construction project ever done by the Seabees anywhere in the world." He and his men are unabashedly proud of their work at the South Pole. Temperatures rarely rise above 20 below zero, winds average 14 miles an hour, and the elevation is 9,186 feet. Under such conditions the men can work outside at most three hours at a time. The efficiency of powered equipment is only a third what it is at normal temperatures and elevations. A crane that normally can lift 15 tons can lift only 5 tons at the South Pole.

Nevertheless, thanks to good weather this summer and a steady flow of materials (86 flights of cargo were flown into the South Pole construction site during the first two months of the season, Oct. 9 to Dec. 9), construction is well ahead of schedule. No problems are anticipated in occupying the new station later this year during the 1974-75 summer research season. The new station will probably be dedicated a year from now, in January 1975.

The Seabees were also spurred on by the knowledge that this is their last season in Antarctica. The Navy is withdrawing the Seabees from Antarctica. All construction remaining next season, plus the installation of building interiors and the conduct of all support services at the new South Pole station, will be conducted in the future by a private company, Holmes & Narver of Anaheim, Calif., under contract, as the Navy is now, to the National Science Foundation.

* * * *

Antarctica is unique in more than its physical setting. Under terms of the Antarctic Treaty of 1959, the entire continent is to be used "for peaceful purposes only." Military operations and weapons tests are prohibited (the use of military personnel or equipment for logistical support of the scientists is allowed). Freedom of scientific investigation is encouraged. Plans for research programs and scientific observations and results are exchanged and made freely available. Scientists are exchanged between the expeditions and stations of the dozen nations doing research in Antarctica. All territorial claims in Antarctica are in abeyance as long as the treaty is in force.

Ralph Payne/Navy

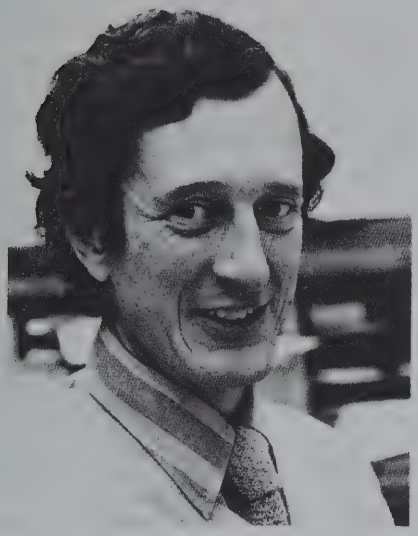
Above right: Portion of Antarctica's pristine Lake Bonney, one of the few lakes in the world not influenced by human pollution. Its biologically simple ecosystem is the subject of a detailed study. Left: A Weddell seal and her pup.

Kendrick Frazier

Antarctica is, in short, a continent devoted to scientific research, with no political boundaries. The high purposes of the treaty seem to be cheerfully adhered to in both fact and spirit. A U.S. flight from the U.S.'s McMurdo Station to the U.S.S.R.'s Vostok Station on Dec. 14 (the first airplane of any sort to reach that isolated outpost since February 1973) took a group of American visitors to Vostok, where they were greeted with "Merry Christmas" signs, vodka toasts and caviar. The plane left behind one U.S. scientist who will stay at Vostok for the next year, and returned to McMurdo with four Russian scientists, who spent the next two weeks visiting U.S. field research sites. One of them, Peter Astakov, saw many familiar faces among the Americans. He had been at McMurdo several times before, and in 1967 he "wintered over" at the U.S. South Pole station.

This experience in cooperation throughout Antarctica is often seen as a model for greater world brotherhood. American scientists might not share all his political views, but many would echo these words of Ye. K. Fedorov, a prominent Soviet meteorologist: ". . . . The unification of mankind . . . will be possible . . . if, over the entire globe, there is installed . . . roughly the same type of interaction among countries as we have already attained and are realizing over a period of almost two decades in Antarctica." □

Named Director Of Ohio State's Polar Institute



DAVID ELLIOTT

VETERAN polar scientist Dr. David H. Elliott last month was named director of the University's Institute of Polar Studies.

Associate professor of geology and mineralogy, Dr. Elliott is the fourth to serve as director of the Institute since it was established in 1960. He succeeds Dr. Emanuel D. Rudolph, professor of botany, who has returned to full time teaching duties in the College of Biological Sciences, where he is coordinating the new program in developmental biology.

British-born Dr. Elliott is credited with the first major fossil find in Antarctica on Nov. 23, 1969, while serving as expedition leader from the Institute. The discovery of vertebrate fossils at Coalsack Bluff some 400 miles from the South Pole was recognized by the scientific world as conclusive evidence that the Antarctic continent was linked with other southern hemisphere continents some 200 million years ago.

In 1968 the British Polar Medal was presented to Dr. Elliott, who had been a member of a four-man team that in 1967 discovered the first land-vertebrate fossils in Antarctica.

The Columbus *Citizen-Journal* named him as one of the Top Ten Men for 1969 in the capital city.

The author of a number of technical articles on polar research, he graduated from Cambridge University in 1959 and received his PhD from Birmingham University in 1965. Dr. Elliott served as a geologist with the British Antarctic Survey from 1960-66 when he joined the Institute of Polar Studies as a post-doctoral research fellow.

Previous directors of the Institute were: Dr. Richard P. Goldthwait, 1960-65, now professor of geology and mineralogy; Dr. Colin Bull, 1965-69, now dean of the College of Mathematics and Physical Sciences; and Dr. Rudolph, 1969-73. Dr. John F. Splettstoesser has served as acting director since July 1.

December 1973

Warren Denner new director at UA's NARL

Dr. Warren W. Denner, an oceanographer who helped to assess coastal damage following Alaska's 1964 earthquake and has conducted research on Arctic Ocean ice stations, has been appointed director of the Naval Arctic Research Laboratory (NARL) at Point Barrow.

Denner, 35, succeeds John F. Schindler who resigned the position in mid-December after 13 1/2 years at the Point Barrow facility. He had been director since 1971.

The University of Alaska, which operates NARL under contract with the Office of Naval Research, appointed Denner to the directorship of the facility. His name was at the top of the Navy's list of qualified applicants. Nearly two dozen persons had applied for the position.

Denner will receive a salary of $32,100 a year in his new position. His contract was effective Dec. 1, 1973.

The scientist comes to Alaska from Monterey, Calif., where since 1964 he had been an associate professor of oceanography at the Naval Postgraduate School. Since 1971 he has also been a partner in an environmental research firm.

He received a B.S. degree from Portland State College in 1961 and his M.S. and Ph.D. degrees from Oregon State University in 1963 and 1969, respectively. The advanced degrees were in physical oceanography. His other areas of graduate study were marine geophysics, mathematics and meteorology. He has been a teacher as well as a research scientist.

Before joining the staff of the Naval Postgraduate School, Denner had held professional positions with the Division of Earth Sciences at the Naval Ordinance Test Station, China Lake, California, and with the University of Alaska's Institute of Marine Science.

He has long been interested in the Arctic and since 1969 has concentrated on Arctic research.

As director of NARL, he will have the responsibility of providing support for government-sponsored arctic research projects on land and sea, which includes transportation to and from remote sites, field housing, supply and resupply, and housing and laboratory facilities at Point Barrow. He will also serve as advisor to visiting scientists.

Denner is married and has two sons.

ANTARCTIC SOCIETY

Life member appointed

Mr H. F. Griffiths was appointed a life member of the New Zealand Antarctic Society at its annual meeting held in Wellington

Mr Griffiths, whose association with the Antarctic extends back to Rear-Admiral R. E. Byrd's 1928-1930 expedition, is a former national president, and founded the Canterbury and Dunedin branches. He is a former president of the Canterbury branch.

Mr Griffiths has visited the Antarctic twice. He is a member of the American Polar Society and a fellow of the Royal Geographic Society.

Other officers of the society elected are: president, Mr J. A. Cross (Canterbury); vice-president, Mr G. W. Markham (Wellington); secretary, Mrs B. Hale (Canterbury); treasurer, Mr R. G. McElrea (Canterbury); editor of "Antarctic," Mr J. M. Caffin (Canterbury).

Greenland Cold, Despite Name

Eric the Red, in what may have been the earliest real estate promotion in North American history, gave Greenland its name to lure immigrants.

South Pole dome done

The new geodesic dome complex at the South Pole has been officially handed over to the National Science Foundation by the Navy Construction Battalion which has been responsible for building it over the last two summer seasons.

However, no-one will actually move inside the new station until next summer. After Palmer Station and Siple Station it will then become the third American base in the Antarctic to house only civilian scientists during the winter.

Siple Station, in Ellsworth Land, 1250 miles from McMurdo Station, was officially closed for the summer on Monday; and now the only communication the four civilians who will man it through the winter will have with the outside world will be by radio.

Another Antarctic base which has ceased to have physical contact with the outside world is New Zealand's Vanda Station in the Wright Valley. The last helicopter flight to it from McMurdo Station was on Monday.

The United States Navy supply ship, the Private John R. Towle, left Christchurch yesterday bound for McMurdo Sound with the annual supply of provisions for Scott Base.

Feb. 6

Alaskan Pipeline Brings New Realities To Eskimos and Engineers in the Arctic

By A. M. ROSENTHAL
The New York Times

BARROW, Alaska, June 12 —On the North Slope, a country-sized sweep of mountain range, coastline and thinly layered mossy soil atop the everlasting ice on the land, there

The Talk of North Slope

are just about 5,000 people and they are all learning fast the new realities that make up life and work in the Alaskan Arctic.

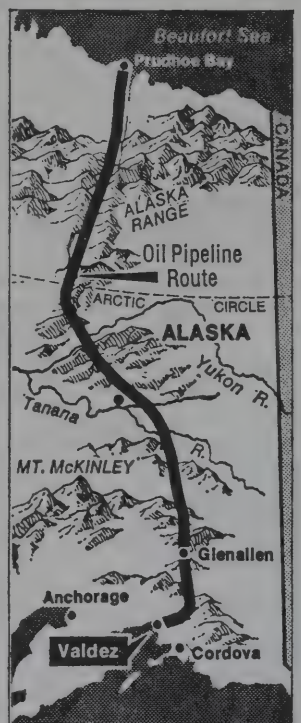
Although not one of the great linking tubes is yet in place, the pipeline that someday will carry about two million barrels of hot oil a day from Prudhoe Bay on the Arctic Ocean south to the little town of Valdez on Prince William Sound is already dominating not just what people talk about but also how they think, how they act, how they relate to others and their concepts of the meaning of power.

For the Eskimos, about 4,100 of them in the vast stretch from the Canadian Yukon to the Bering Sea, and for the 900 or so engineers, drillers, technicians and roustabouts at the wellhead and pipeline camps, the realities are based on oil—they have that in common.

As far as the Eskimos are concerned, the lessons being learned have to do with oil royalties, trying to make sure that the icy acreage they will be getting from Federal properties will be oil-bearing land, and reorganizing a primitive society so as to retain some old values while adjusting to new ones.

Barrow is muddy and garbage strewn in the spring thaw, which uncovers heaps of refuse thrown out the door all winter. The town still has a couple of sod igloos, but it has more photocopiers and desk calculators. They are in the offices of Eskimo politicians and community organizers, who know quite a bit now about target voting and Price-Waterhouse audits. All these things are part of power and influence in this northernmost outpost of the United States, whose population of 3,000 makes it the largest Eskimo town anywhere.

Eben Hobson, the wiry Mayor of the North Slope Borough, who has declared for Governor in the Democratic primary but does not



The New York Times

stand much of a chance of becoming Alaska's first Eskimo Governor in this election, knows what power is and also knows that it is still limited for the Eskimo.

When the borough wanted the right to tax the oil companies with heavy property assessments, it was stopped in the state capital, which set a ceiling Mr. Hobson says is not enough to bring in running water and sanitation.

But he knows there will be more money, lots of it, coming to the Eskimo communities in the years ahead. In the meantime, there is a primary day and then an Election Day coming up and, although the Eskimo vote cannot elect a candidate, it can help or hurt. Barrow is muddy and dirty, but it is very much a part of Alaskan economics and politics and it realizes its stake and power in both.

About 200 miles to the east, along the coast at Prudhoe Bay, Atlantic Richfield and British Petroleum are working on a 30-by-12-mile site that is one of the richest oil fields in the world.

Big money — hundreds of millions of dollars — already has been spent by Atlantic Richfield and BP and the other lease-holding oil companies for whom they are developing the site — money for leases, for camps that range from simple snugness to resort elegance, for exporing, for drilling, for onsite refining needed before the crude can go into the pipeline, and for huge machines and delicate instruments.

Money and machinery are power in the Arctic, as they are everywhere, and so are the brains and experience of the specialists at the camps. There are petroleum engineers who have spent a lifetime in the business, finding and bringing up oil from Texas, the Middle East, Pakistan and Indonesia. There are mechanical engineers who test the welding of the pipes with laser beams and computers, and there are chemists and meteorologists and metallurgists. A few are scholarly looking men in esthetic uniforms, eyeglasses and beards. Many look as if they were wearing football shoulder pads. But they are experts all, members of the technological élite.

But they and the vice presidents who fly in from Anchorage or from corporate headquarters in Los Angeles or London are totally aware that the new reality is that, to get oil out of Prudhoe these days, other kinds of influence and power have to be taken into account in addition to that of money, machines and expertise: the power of Alaskan voters, including the Eskimos; the power of politicians at the state capital in Juneau, 1,600 miles away; the power of newspapers and broadcasters, and the power of the ecologists.

At the Atlantic Richfield camp, the engineers and executives concede almost eagerly that the ecologists and the environmentalists not only have to be reckoned with, but have also been an influence for the good.

The oilmen are still horrified at the "extremist" environmentalists — those who are against development of Prudhoe at all, against the whole idea of the pipeline. But the ARCO people repeatedly volunteer their belief that, if there had been no environmental movement, the wells would have been dug and the pipeline built quite differently, and without too much real care for tearing up the tundra — the endless thousands of miles of delicate plant life and mossy soil covering the permafrost.

The tundra. In the long winters it is covered with snow. In the spring it becomes a sea of mud, and then in the summer it comes alive with a thousand varieties of flowers and grasses. But snow-covered, muddy or flowering, its vegetation is the starting point of the Arctic life cycle — food for species that are fed on by other species and by man.

The tundra is thin, soft and sensitive. Heavy machinery dragged across the tundra can create ruts that eternally scar the permafrost and upset the whole cycle of Arctic life.

Those days are over, the oilmen insist, over because the ecologists' fuss brought about protective rules and regulations. But there are environmentalists all over the world — including Alaska — who are not at all that convinced that the danger is over, or that the chief interest of the oil companies is now botany.

Whether the danger is over or still existing at the ARCO camp the engineers talk about the tundra ceaselessly. They peer at it fondly, cample it, roam over it by helicopter to spot the caribou and the birds and, almost like students before a professor, question the staff ecologist, a Scot-Canadian, to make sure nothing is going wrong with ARCO's tundra protection.

The ecologist, Angus Gavin, a man who can sight a fox a mile away and from a helicopter diagnose a caribou as pregnant, knows quite well that the oilmen became interested in the Arctic environment not through sudden altruism, but because that was the price of the digging.

But, whatever the reason and whatever the future, ecology is part of power at Prudhoe and Angus Gavin says he thinks the oilmen at the camps are rather happier with themselves nowadays. And he says that is understandable, being that everybody is human.

●

ARCO works the eastern part of the field and BP the western part. When the pipeline is built and oil starts flowing into the tankers that will be coming into Valdez

—if there is one spill there Los Angeles and London will have something else to worry about aside from tundra wildlife—each company will share heavily in the profits. So what is good for ARCO is good for BP, but BP is putting a slightly strained look to the collegial smile on ARCO's face. It has to do with camps.

"Camp" hardly describes ARCO's Prudhoe headquarters. It is a handsome complex of buildings with pleasantly furnished rooms and recreataion areas and an unending supply of excellent steaks, roasts, pies and ice cream for the crews. Ambance pleasant, food three stars. The Arctic is fattening.

But now, eight miles away, along comes BP with a light, airy, and glistening new "camp" costing more than $20-million — lounges in swank leather, pastel walls, a near-Olympic swimming pool, steam baths, saunas, an indoor garden complete with Prudhoe's only trees, an all-weather exercise area with a glass roof and radiant heating floor.

The ARCO men looked a little dazed and glum when a BP public relations man took them on a tour, but grinned when somebody said it was nothing much unless you happen to like beauty and luxurious comfort, and anyway, was all an example of foreign decadence.

Bikinis! Bikinis hang in the BP sauna room, and that's as much of a sociological news item as computers at Barrow and flower-minded oil prospectors. The rule of the Arctic camps has been no liquor, no gambling, no women. But BP has 10 women at what it hopes will not be called the Prudhoe Plaza, and there have been women geologists spending some days and nights at a considerably more rugged pipeline camp.

One young woman in Fairbanks has brought a discrimination suit against a union agent who she says gave her the runaround when she applied for a job at a camp as a cook. Some of the oilmen would rather not talk about it too much, but even they agree the future is clear and that they cannot really say that the oil will freeze in the pipeline because of it all.

Different societies in different stages, and enormous investment, plainly make for complexities within complexities. But what can be learned about Alaska quickly is that it is so very beautiful, so ceaselessly and changingly and sometimes frighteningly beautiful.

It is a place where all the seasons and colors come together at one time. Anchorage is gently warm and greening, and northward the mountains are blue with the blue of the glacier, then there is the brown of the awakening tundra and then, flying out over the Arctic sea, there is first the hundred different greens of the melting ice and then the white of the never-melting ice mass. White ice and white clouds and white fog come together and bring a touch of fear—something like being lost and wandering in a world of milk.

Long ago, as Alaskans measure time in this young state, away back in 1899, Henry Gannett, then chief geographer of the United States Geological Survey, was struggling to describe the beauties of Alaska, and like everybody else, failed. But he is remembered for writing this advice to those intending to visit Alaska for the first time:

"If you are old go by all means; but if you are young stay away until you grow older. The scenery of Alaska is so much grander than anything else of the kind in the world that, once beheld, all other scenery becomes flat and insipid. It is not well to dull one's capacity for such enjoyment by seeing the finest first."

Whaling Meeting Shows Signs Of a Priority for Conservation

The New York Times

LONDON, June 30—Evidence emerged at the 26th annual meeting of the International Whaling Commission in London last week that the 15 member nations, succumbing to world opinion, were giving priority to the survival of the whale over the interests of the whaling industry.

The evidence was scarcely enough to satisfy those who call for a total moratorium on the killing of whales. However, a resolution calling for selective moratoriums encouraged hope that in the future whales would not be hunted to the point of extinction.

For the first time the commission has the power, under the resolution, to impose a moratorium of indefinite duration on species before their numbers fall so low that it is no longer feasible to hunt them. In the past the commission has imposed moratoriums only on whales that had been reduced to commercial, if not biological, extinction.

The first selective moratorium, to take effect next year, is certain to cover the fin whale. There are estimated to be no more than 100,000 of them, three-quarters of their number having been killed.

The fin is the largest of four whales still hunted profitably, mostly by the Russians and the Japanese.

The Soviet Union and Japan were the only countries that voted against the selective moratorium. Although they opposed the resolution, it is thought that they will observe a ban on the hunting of the fin imposed by the whaling commission.

Under the commission's rules, countries need only lodge objections within 90 days not to be bound by its measures.

At last year's meeting both countries for the first time nullified three significant commission agreements by lodging objections. They exceeded the quotas set annually by the commission on the sperm and minke whales and refused to observe a phasing out of fin whaling in the Antarctic by 1976.

Growing confidence that the Soviet Union and Japan will now accede to the wishes of conservationists against their own whaling interests was widely shared among other delegates at the week-long meeting in Riverwalk House on the banks of the Thames.

"One of the great pluses of this meeting," one Western delegate said, "was the attitude of the Russians. They seemed quite prepared to accept more readily the conservationist measures being proposed. In fact, they were quite cooperative."

The Japanese, on the other hand, "stonewalled virtually everything," the delegate added. "But the strong tide running against their exploitation of the whale and the boycott of Japanese goods by American consumers must make them reconsider their attitudes."

Should Japan and the Soviet Union not lodge objections against the selective moratorium it would be a watershed in the history of the commission, which was set up under an international convention in 1948. It has been accused of being a rubber stamp for the world's whaling industry.

Indeed, the last paragraph of the preamble of the convention states that the paramount consideration was economic, that is, "to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry."

For the first 15 years of its existence the commission set quotas that were calculated to insure the survival of the whaling industry. The first reduction in quotas came at the 1963 meeting.

It was not until the late nineteen-sixties that total bans were placed on the blue and humpback whales. Their numbers are now estimated at 7,500 and 3,000, respectively.

The other two totally protected species are the right whale, which now numbers about 5,000, and the gray, of which there are about 11,000.

Russians Find Artifacts Like American Indians'

MOSCOW, April 6 (AP)—Soviet scientists have discovered archeological evidence supporting the theory that ancient Asian tribes migrated to the American continent over what is now the Bering Strait, according to the official press agency Tass.

The head of an expedition to the peninsula of Kamchatka on the Soviet Union's Pacific coast said his group had discovered objects such as beads and belts that had previously been found only on American territory, the agency said.

He called the objects the forerunner of the American Indians' "wampum." Another member of the expedition described the find as "staggeringly unexpected." Tass added.

The expedition head, Nikolai Dikov, felt the migration apparently occurred in the Ice Age when Asia was connected to North America by land

Diamond Probe In Greenland Set

COPENHAGEN, May 12—The world's largest diamond mining corporation, South Africa's De Beers company, will investigate reports that there may be diamonds in Greenland, the Aarhus Stifstidende newspaper reported today.

The diamonds were found at Fiskenaesset, near the southern tip of Greenland, by a Canadian diamond mining company.

Fall Into Crevasse Kills Icebreaker Fuji Crewman

Leading Seaman Fumio Aratani, 23, a crew member of the Japanese Antarctic observation icebreaker Fuji, was killed on Tuesday, New Year's Day, after falling into a crevasse of iceberg while making meteorological research on the icebound Antarctic Ocean, according to a report from the icebreaker

The accident occurred at about 11.30 am (8.30 pm Tuesday, Japan Time) while Aratani, of the Maritime Self-Defense Force, was engaged in the research along with one of his colleagues on the iceberg about 650 meters from the ice breaker on the ice field, the report said.

After falling into a 20-meter deep fissure which had been covered with fresh snow, it said, he had been taken back to the icebreaker, but died at 1.53 pm (10.53 pm Japan Time) the same day with fractured skull.

At the time of the accident, the 5,250-ton icebreaker was located about 60 kilometers northwest of the Japanese Showa Antarctic Base on its way to the base, with 40 members of the 15th Antarctic observation team and a crew of 182, according to the Education Ministry.

The expedition, led by Masayoshi Murayama, had set sail from Tokyo on December 25.

The death of Aratani was the second fatal accident involving Japanese Antarctic observation members following the death of Shin Fukushima a member of the Fourth wintering team, who had become missing from the Showa Base in October, 1960.

Aratani

The report from the icebreaker also said the funeral for Aratani was scheduled to be held early Thursday morning (Thursday afternoon Japan Time) aboard the ship following his posthumous promotion to third-class sergeant.

The sad news was brought to Aratani's home in Nagareyama, Chiba-ken, by the MSDF shortly after 7.30 pm Tuesday when his parents and relatives were enjoying a New Year's banquet.

His father Masanobu Aratani, 62, said: "We received the news of my son's death just after we had got his New Year's greeting telegraph on the same day as he was killed, and feel as if his death cannot be true."

Dr. Edward Little, 76, Dies; Expert on Arctic Icefields

SAN DIEGO, June 25 (UPI)— Dr. Edward Little, a leading researcher on the Arctic ice fields and on polar survival, died Saturday. He was 76 years old.

Dr. Little made 15 trips to the Arctic to study the properties of Arctic ice, eight of them aboard Navy icebreakers. He served as assistant head of the department of geophysics of the University of Alaska.

During World War II, Dr. Little led an Army expedition to the Hudson Bay area of Canada to test Arctic survival equipment and later explored the Arctic Ocean with an expedition from the University of Washington.

He was a member of the Explorers Club of New York and the Sierra Club and was director of ski touring for the Far West Ski Association.

Dr. Little jointed the Naval Electronicis Laboratory here in 1952, retiring in 1967.

Fishermen in Bering Sea Net Record King Crab Haul

JUNEAU, Alaska (UPI) — Fishermen caught a record 27 million pounds of King crab in the Bering Sea in 1973. The catch was more than 5 million pounds greater than the 1972 harvest.

The crabs were worth almost $16-million to the fishermen who used 5 boats in the fishery.

Bering Sea Fishermen also landed about 300,000 pounds of tanner crab.

Greenland will release this 1.50-krone stamp on Feb. 21, report postal officials. The issue is an addition to the nation's continuing series illustrating types of traffic and conveyance of mail throughout the ages. The motif shows the longboat "Karen" registered from Jakobshavn and is the last of its kind. The designer is Jens Rosing; engraving is by C. Slania.

New Greenland Stamps April 1974

Date of issue: 16th May, 1974. Denominations: Kr. 1,00 and 2,00
Colours: Kr. 1,00: red. Kr. 2,00: brown. Paper: Ordinary
Size: 1½ times the size of an ordinary stamp in sheets of 50 stamps each.
Designed by: Jens Rosing. Engraved by: Czeslaw Slania.
Type: The Royal Greenland Trade Department – issued in the occasion of the Bicentenary of the Department.

The appearance of the stamps is as shown on the below reproductions.

For most of the 200 years the Royal Greenland Trade Department (in the abbreviated form of the Danish name known as KGH) had its place – called Trangraven – at the end of Strandgade in Copenhagen. Here the barrels filled with blubber from whales and seals for production of oil for the lamps of Europe were discharged.

The newest activity of KGH is the trawling in the Greenland waters. The connection between the past and the present is indicated on the stamp by the two kayakers looking at the „colleague" of the present on the way to trawling in the Davisstrait.

John Hanessian

By Jean R. Hailey
Washington Post Staff Writer

March 7

John Hanessian Jr., 49, an official of the National Science Foundation and an authority on political science and international relations, was one of the 344 persons killed Sunday in the crash of a Turkish airliner near Paris.

He was en route from Paris to London on the last leg of a European trip for the foundation, where he was program manager in the office of exploratory research and problem assessment.

Mr. Hanessian had left here Feb. 18 to attend a conference on direct broadcast satellites in Italy and had met with United Nations officials in Switzerland and officials of the Organization for Economic Cooperation and Development and of UNESCO in Paris before boarding the plane, a DC-10 jetliner.

He was to have met with the Science Policy Research Unit of the University of Sussex in England and was scheduled to return to Washington yesterday.

With the Foundation for the past two years, Mr. Hanessian was on leave from George Washington University, where he was a senior staff scientist on the professional staff of the university's Program of Policy Studies in Science and Technology.

He had been named director of the International Studies Group of the program and also associate professor of international affairs in the School of Public and International Affairs at GWU in 1967.

Instruction involves international law, politics and organization, science, technology and world order.

A noted educator, lecturer, researcher and author, Mr. Hanessian was a consultant to the UN and the State Department.

He also was active in Armenian affairs, serving as chairman of the Armenian Assembly, headquartered here, and as a member of the board of the National Association for Armenian Studies and Research.

JOHN HANESSIAN JR.

Born in Syracuse, N.Y., Mr. Hanessian graduated from Syracuse University after serving with the Army during World War II. He took further studies at North Carolina State College, the University of Strasburg in France and the Johns Hopkins School of Advanced International Studies and had completed his doctorate requirements in international law at Cambridge University in England.

He was on the staff of the National Academy of Sciences from 1954 to 1958 and was sent to both the North and South Poles during the International Geophysical Year.

From 1960 to 1964, Mr. Hanessian was a staff associate with the American Uni York.

In this capacity, he was a visiting proefssor at American University of Beirut in Lebanon for two years and also did research for AUFS in the Middle East, Russia, Europe and the Pacific area. He lectured at numerous universities and colleges in this country.

Before coming to Washington, Mr. Hanessian had taught at the University of Alabama, the University of Hawaii and California State College at Los Angeles and at Long Beach. He also had been acting director of the Arms Control Study Group, California Institute of Technology—Jet Propulsion Laboratory, in Pasadena.

He was the author of or contributor to numerous publications on arms control, outer space affairs, international politics and law and Middle East affairs.

The many organizations to which Mr. Hanessian belonged included the American Society of International Law, the American Political Science Association, the American Academy of Political and Social Sciences, the London Institute of World Affairs, the Middle East Institute and the Antarctican Society.

He is survived by his wife, Alice, and four sons. Bruce, Bryan, Christopher and Jonathan, of the home, 7706 Hamilton Spring Rd., Bethesda, and his mother, Haigouhie Ellezian Hanessian, and a brother, Haig Hanessian, both of Ft. Lauderdale, Fla.

HENRY DATER, 65, NAVAL HISTORIAN

Writer on U.S. Operations in Antarctica Is Dead

The New York Times

WASHINGTON, June 27—

Dr. Henry M. Dater, historian and principal chronicler of United States Antarctic operations since their beginning in 1947, died yesterday of cancer in Washington. He was 65 years old.

Dr. Dater, a native of Brooklyn, received a bachelor's degree from Yale in 1931 and a Doctor of Philosophy degree in history in 1936.

From 1936 to 1943 he was associated with Kent State University, where he became an associate professor of history.

He joined the Navy in 1943 and served in Washington until 1946, when he was released with the rank of lieutenant commander. He then rejoined the Navy as a civilian employe, and remained with it until his death.

For the first six years of his civilian Navy career, Dr. Dater was chief of the aviation and research section in the office of the Chief of Naval Operations. This was followed by tours of duty as deputy historian in the Office of the Secretary of Defense; staff historian and officer in charge of United States Antarctic programs; historian of the Antarctic Projects Office and chief of the history and research division, Naval Support Force Antarctica.

For his work, he received the Navy's highest civilian award, the Distinguished Service Award.

Dr. Dater was co-author with Emil Schulthess and G. J. Dufek of "Antarctica." Other books by him were "Aviation in the Antarctic" and "Dakotas in the Antarctic."

He was one of six honorary members of the Antarctican Society.

Surviving are his widow, the former Alice Whittaker; two sons, Henry M. Dater 3d of Billings, Mont., and Anthony of Concord, N.H.; a sister, Mrs. James Dayton of Amherst, Mass., and two grandchildren.

Mikhail Somov, Explorer, Dies; Led Soviet Polar Expeditions

Dr. Mikhail M. Somov, a Soviet polar explorer, has died at the age of 65.

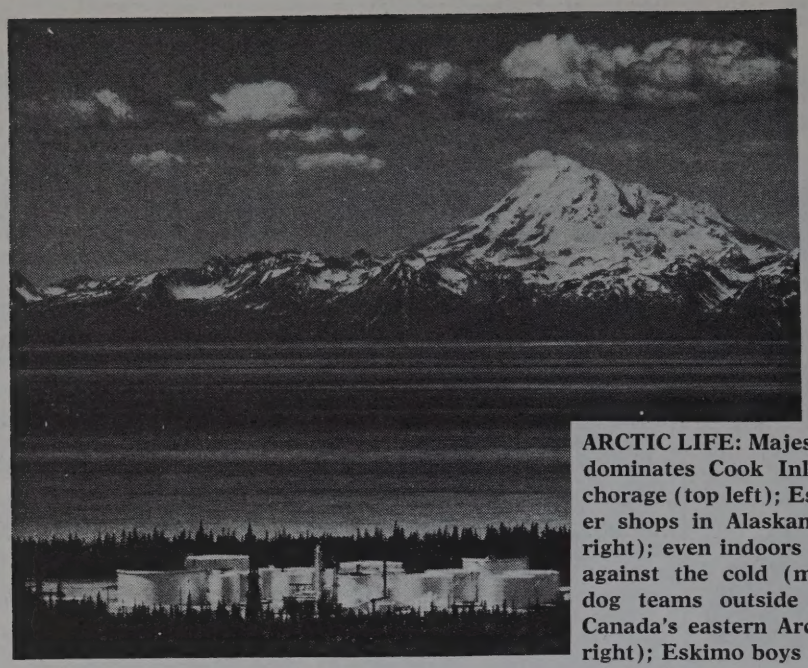
A specialist in sea ice studies, Dr. Somov led the first Soviet expedition to Antarctica in 1955-57, when several countries set up stations on the continent in connection with the International Geophysical Year.

Under his leadership, the Soviet expedition established the main coastal base of Mirny, meaning "peaceful," and drove 230 miles inland to set up the station of Pionerskaya.

Dr. Somov devoted his life to polar exploration after having been graduated in 1937 from the Moscow Hydrometeorological Institute. During World War II, he served in Arctic military units that halted an incursion by the Nazi battleship Admiral Scheer along the north Siberian coast.

In 1950-51, he headed a Soviet group on the drifting ice station North Pole—, the first of a series of floating research bases established by the Russians in the postwar period. He later served as deputy director of the Arctic and Antarctic Institute in Leningrad.

Held in high regard among polar explorers the world over, Dr. Somov was awarded gold medals by the Swedish Royal Society of Georgraphy and Anthropology in 1959 and by the Royal Geographical Society in London in 1961. Jan. 3



ARCTIC LIFE: Majestic snowcap dominates Cook Inlet near Anchorage (top left); Eskimo mother shops in Alaskan town (top right); even indoors they bundle against the cold (middle left); dog teams outside Igloolik in Canada's eastern Arctic (middle right); Eskimo boys romp under whale-rib arches (lower left); pre-sale showing of assorted Alaskan seal skins (lower right).
Saturday Review